XLV.

WIDMUNG DER AMERIKANISCHEN FESTSCHRIFT AN DEN HERRN GEHEIMEN MEDICINALRATH, PROFESSOR DR. B. FRAENKEL,

VON DR. OTTO FREER.

HOCHVEREHRTER MEISTER:

In dieser Sammelschrift begrüssen die Hals- und Nasenärzte der Vereinigten Staaten Sie als Führer in unserer edlen Wissentschaft, voll des Dankes für das Grosse das Sie als Forscher und Lehrer geleistet haben. Doch nicht allein dieses würdigen wir in Ihnen sondern wir erkennen auch mit Begeisterung den veredelnden Einfluss Ihres Strebens auf das Gedeihen der Laryngologie und Rhinologie an, denn das Beispiel ernster, streng wissenschaftlicher Arbeit das Sie den laryngologischen Schriftstellern der Welt gegeben haben, hat sie angespornt ähnlich Gediegenes zu schaffen und gleichsam als ob Sie ihnen prüfend zur Seite ständen, Halbheit und Oberflächlichkeit in ihrem Thun und Denken zu vermeiden. Ihr Archiv, eine

Schatzkammer für das Vorzüglichste in unserem Fache und der Ausdruck Ihres nur das Beste erwählenden Wesens, hat Sie uns Allen nahe gebracht, so dass auch diejenigen von uns welche nicht des Glück hatten Ihnen zu begegnen dennoch das Gefühl Ihrer freundlich ermahnenden und ermuthigenden Gegenwart im Geiste haben. Auf solche Weise arbeiten Sie nicht allein mit eigenem Denken sondern Sie leiten den Gedankengang und die Arbeitsweise vieler Jünger in allen Ländern und begeistern sie ihre besten Kräfte der Forschung zu widmen. Lange nach dem wir Alle von der Erde verschwunden sein werden wird Ihr Archiv, welches auf alle Zeit Ihren Namen tragen sollte, ein immer wachsender Schatz für die Nachwelt sein. Sein hochwissentschaftlicher Standpunkt hat nicht wenig dazu beigetragen die Laryngologie zum selstständigen Fache emporzuheben und sie davor zu bewahren ein blosses Anhängsel der Otologie oder gar der Ophthalmo-Otologie zu sein. Es ist aber noch viel zu thun um für die Hals und Nasenwissentschaft die ihr gebührende Würdigung zu erlangen und mögen Ihnen, Herr Geheimrath, noch viele Jahre gegeben werden, als unser leitender Geist, der Laryngologie und Rhinologie Gleichberechtigung neben ihren stolzen Schwestern in der Medizin zu verschaffen.

XLVI.

BERNHARD FRAENKEL — WHAT HE HAS DONE FOR RHINO-LARYNGOLOGY.

By W. FREUDENTHAL, M. D.,

NEW YORK.

Early in June, when the writer prepared for a long journey to Arizona, New Mexico, etc., a prominent German physician invited him to dinner on board his steamship — a dinner which he gave in response to many courtesies received from American colleagues. When the writer declined on account of his contemplated journey to Arizona the next day, the Doctor jokingly remarked, "O, you mean that mythical land where the 'kicker' grows."

I do not need to assure my readers that Arizona is not mythical, but real; nor was my trip a myth, but a fact. After I had left New York it was decided to celebrate, in this country, the seventieth birthday of Professor Bernhard Fraenkel by a special number of the ANNALS dedicated to him. Hence, I have prepared my contribution rather in a hasty way. Part of it was written while camping at an altitude of about ten thousand feet on the bank of the beautiful Ruidoso River, in New Mexico, nearly three thousand miles away from my home. The rest was completed after my return to New York with the aid of some data kindly furnished to me by Dr. A. Alexander of Berlin. The shortcomings of an article written under such circumstances are naturally very great, and in this instance they are much to be regretted, in view of the high esteem which I hold for my distinguished friend and teacher, Professor Fraenkel. If the time had not been so very limited, perhaps something better would have been presented.

Bernhard Fraenkel was born on November 17th, 1836, at Elberfeld, in Rhenish Prussia. He received his preliminary education at the " Gymnasium " of that place, and went in 1855 to the University of Würzburg to pursue his medical studies, and a year later to Berlin, where he has remained

since. In 1859 he was graduated at Berlin, his thesis being on perityphlitis, dedicated to the well-known ophthalmogist, Carl Pagenstecher, of Elberfeld, to whom he felt much indebted.

Through Pagenstecher he became acquainted with Professor Virchow, in whose pathologic institute he received a great impetus for scientific research. He became especially acquainted with Virchow's assistant, Professor Julius Cohnheim. It is undoubtedly due to this early training in the microscopic field that Fraenkel later on did such excellent work on the normal and pathologic histology of the larynx.

Together with Cohnheim he studied different phases of tuberculosis as early as 1868-69, evidence of which is to be found in his paper published in the *Berliner klin. Woch.*, No. 1, 1872, entitled, "Further Observations on Tuberculosis of the Choroidea." Among Fraenkel's other teachers were such men as Koelliker, Johannes Müller, Virchow, Langenbeck, Traube, du Bois Reymond, Gräfe and Henoch.

In 1871 Fraenkel took part in the Franco-Prussian war, and upon his return he established himself as "Privat Dozent" at the University of Berlin in the Department of Rhinolaryngology, and worked there in company with George Lewin, Tobold and Waldenburg. As the result of Czermak-Türck's teachings with the laryngeal mirror in Austria, as well as Voltolini's first observations in this field in Germany and Victor von Bruns' first successful removal of a tumor from the larynx per vias naturales, he was led to devote his time principally to laryngology. Still, he had started as a general practitioner, and remained one for quite some time. I believe even now he still has some general practice.

In 1873, he was made Visiting Chief of the Internal Division of the Augusta Hospital, a position now held by no less a man than Professor Ewald of Berlin. Soon, however, he resigned this position and devoted himself exclusively to work in laryngology in a private clinic which he established. For many years this dispensary was maintained solely by him in his private residence in a fashionable neighborhood near Unter den Linden in Berlin, at a great expenditure of time and money. It is a source of great pleasure to me to recollect the many pleasant instructive hours I spent there under him. Finally, at his urgent and continued request, the government established a university dispensary, and when

it was opened in 1887 Fraenkel was made its director. Only a few years ago, May 2nd, 1901, a clinic with a large number of beds was opened at the Charité Hospital.

Thus he was enabled to give up his private clinic after having obtained governmental recognition of the fact that laryngology was entitled to the same privileges as other branches of medicine which had previously been established. In spite of this, Fraenkel, who in 1887, had received a title of Professor, was later appointed extraordinary professor at the University of Berlin. Why he was not, like the professor of ophthalmology, made an ordinary professor at that university, I do not know. At least, I am sure we all believe that laryngology is of equal importance with ophthalmology. Still, Fraenkel had every reason to congratulate himself on his achievement so far, and no doubt his successor will find it easier to secure for laryngology the full recognition to which it is entitled. At any rate, Fraenkel was the first laryngologist to receive the extraordinary professorship in Germany.

Fraenkel was married happily until 1888, when his wife died of cerebro-spinal meningitis, which she contracted while visiting one of her servants at the hospital.

It is difficult to do justice to all that Fraenkel has achieved in laryngology. I shall, therefore, limit myself to only the most important features of his life work. Probably all of us have read his work on diseases of the nose and larynx, published early in the seventies in *von Ziemssen's Handbook*. In this book are described a great many instruments originated by him which are still used—for example, his nasal speculum and tongue depressor. To mention one point only, I will say that in the chapter on ozena Fraenkel describes this condition so accurately and carefully that it still serves as a model. In a paper read before the International Medical Congress at Madrid, the writer, after careful studies, reached exactly the same results regarding ozena that Frankel had published about thirty years earlier. It seems as if the majority of authors nowadays coincide with his views on this subject.

Fraenkel was the first to publish his observations on what he called benign mycosis of the pharynx (*Berliner klin. Woch.*, page 94, 1873). Since then, we know that there is such an affection as pharyngomycosis leptothricia benigna. His contributions in *Eulenburg's Real Encyclopedia* are very numer-

ous. In 1886 he demonstrated the infectious nature of lacunar tonsillitis, and by invitation read a paper on that subject before the Laryngological Section of the British Medical Association, July 30th, 1895. He has always tried to interest his students in the question as to how far Waldeyer's lymphatic ring is to be regarded as a portal for infections, and subsequently E. Meyer published "Bacteriologic Findings in Lacunar Angina" and "Fibrinous Rhinitis," both of which articles appeared in *Fraenkel's Archives.*

Next to Voltolini, Fraenkel was the first to call attention to the connection between nasal affections (polypi) and asthma (*Berliner klin. Woch.*, No. 16, 1881). For years afterwards, the question of reflex neuroses in laryngology dominated all others, and now that this subject has been cleared up we recognize the great debt we owe to Bernhard Fraenkel for his contributions in this field.

Among other articles belonging to this category, I would mention the one on "Hyperesthesia of the Nasal Mucosa" (*Berliner klin. Woch.*, No. 15, 1901) on "Railroad Coryza," and several notes in the *International Centralblatt für Laryngologie* for 1887, etc.

I must not omit to mention also the following papers· "On Empyema of the Antrum" (*Berliner klin. Woch.*, No. 11, 1887); "On the Submucous Application of Cocain" (*Ther. Monatsch.*, March, 1887); "Rhinologic Operations During the Era of Cocain" (*D. med. Woch.*, No. 51, 1889); "On Tracheotomy Without General Narcosis with Local Anesthesia" (*Berliner klin. Woch.*, No. 23, 1898).

Important are also his contributions on (1) "Carcinoma of the Larynx"; "First Removal of·Carcinoma of the Larynx per Vias Naturales: Cure" (*Centralb. f. Chir.*, No. 24, 1886); (2) "First Cure for Cancer of the Larynx by Removal per Vias Naturales" (*Langenbeck's Archiv.*, Vol. XXXIV, 1886); (3) "Cancer of the Larynx: Its Diagnosis and Treatment" (*D. med. Woch.*, No. 1, 1889); (4) "The Intralaryngeal Treatment of Cancer of the Larynx" (*Archiv. f. Laryn.*, Vol. VI); (5) "Pachydermia and Carcinoma, etc." (*Archiv. für Laryn.*, Vol. XIII); (6) "Pachydermia of the Larynx: Its Histology, Pathologic Anatomy and Pathology" (*Archiv. für Laryn.*, Vol. II).

Fraenkel's studies in the histology of the larynx were extensive, and at one of the meetings of the Berlin Laryngo-

logical Society he made the assertion that the glands of the vocal cords were responsible for singer's nodules. His observations have not been published, but Fraenkel caused his assistant, Dr. Arthur Alexander, to pursue these studies, and he has embodied the results in "Histologic Contributions to the Formation of Benign Neoplasms of the Vocal Cords," of which so far only two parts have been published, and these are written in a very able and exhaustive manner.

Fraenkel also stimulated studies in paralysis of the vocal cords, and his experiments with Professor Gad are sometimes called historical. In 1896 he founded the *Archiv. für Laryngologie,* of which eighteen volumes have so far appeared, and, with all due respect to similar journals, it must be acknowledged that it is still the most important of them all.

His interest in tuberculosis dates back, as mentioned before, to his studies with the celebrated Professor Cohnheim, and his later work on this subject is very prominent. Very few of us know that in the impulse given by some of our German colleagues to the modern movement in tuberculosis, Fraenkel was the leading spirit — although as a member of the Board of Directors of the German Central Committee he has during all these years modestly kept himself in the background, so that only a few, a very few, are aware of his activity in that direction. That he was really the moving spirit is evidenced by the speech of the presiding officer of the Berlin Congress, Prince von Ratibor, who in his toast to Fraenkel spoke somewhat as follows: "Although every one was alive to the importance of such a congress and nature of its results, still there was one man who made this idea a reality—Bernhard Fraenkel—and I wish to give expression to the feeling of gratitude we all owe to him."

When we consider that this first Congress on Tuberculosis was followed by others of equal importance, namely those of Naples in 1900, London in 1901 and Paris in 1905, and that out of these congresses was developed the idea for a combined battle of all nations against tuberculosis, and when we furthermore consider how much good has already been accomplished in this direction, we can better appreciate the great good already derived from the zeal of Professor Fraenkel. That this battle against tuberculosis will benefit also laryngeal tuberculosis, I have no doubt, although I must

admit that in this State there are many sanatoria which do not admit cases of laryngeal tuberculosis, holding the peculiar view that it indicates an advanced stage of the tubercular process, and that sanatoria have not been established to treat so-called incurable cases.

Fraenkel was the first to see miliary tubercles in the mucosa of the larynx, and he described them in *Berliner klin. Woch.*, No. 4, 1883. Virchow afterwards remarked that for the study of miliary tuberculosis, no organ was better adapted than the larynx. Since that time everyone has often observed such tubercles.

Fraenkel was much interested in Koch's bacillus, and his studies evolved a new method for staining the tubercle bacillus. This was in the year 1884 (see *Berliner klin. Woch.*, No. 13). Unfortunately Gabbet made an unimportant modification of this method, which he published in 1891, and which now goes under his name, but this is unfair, for Fraenkel deserves the credit for it.

His articles on the prophylaxis of tuberculosis, etc., are numerous, and it would take a long time to mention them all.

Fraenkel is the chairman and founder of the Berlin Laryngological Society, the meetings of which are held in his clinic in the Charité. In spite of his seventy years, he is still one of the most active members of that society. I understand that such active participation in scientific proceedings is not so common in other countries, and that in one of the largest cities of the Union the older members are never present in our special societies! I think we can all learn a great deal also in this respect from Professor Fraenkel.

In making these few notes on Fraenkel's life and his contributions to our special literature, I have not mentioned his many papers on general medicine and literature in general. We can appreciate, however, how much he has accomplished to establish a prominent position for laryngology in Germany, and in this respect he has achieved more than any other man before him. I am sure that all our German colleagues look up to him with pride for that alone. But it is not only the man of science and literature that we celebrate to-day, but the honest, upright man who has the rare faculty of inspiring his assistants and co-workers to renewed activity in the field of laryngology. So long as there is scientific research

in that "little corner" of medicine which we call laryngology, so long the name of Bernhard Fraenkel will not be forgotten; and I know that our American confreres take as much pride and pleasure in the celebration of his seventieth birthday as do those of other nations. Let us hope that he may yet live for many years in good health as one of the great leaders of rhino-laryngology.

XLVII.

BERNHARD FRAENKEL'S CONTRIBUTIONS TO MEDICAL LITERATURE.

Prepared by WOLFF FREUDENTHAL, M. D.,

NEW YORK,

AND DR. LANDGRAFF,

BELZIG.

COMPLETE WORKS.

Nonnulla de perityphlitide cum viso reperto.   Dis. 1859, Berlin.

Gefrierdurchschnitte zur Anatomie der Nasenhöhle.   Berlin, 1890-91.   Aug. Hirschwald.

PAPERS WRITTEN FOR LARGE WORKS AND CYCLOPEDIAS AND EDITORIALS.

Allgemeine Diagnostik und Therapie der Krankheiten der Nase, des Nasenrachenraumes, des Rachens und des Kehlkopfes.

Die Krankheiten der Nase.

Handbuch der spec. Pathologie und Therapie, by H. v. Ziemssen, iv, i. 1876.   2nd edition 1879.   Leipzig, Vogel.

Scrophulose und Tuberculose.

Handbuch der Kinderkrankheiten, by C. Gerhardt, iii, i, 1878, Tübingen, H. Laupp.

Angina.

Croup.

Pharynxkrankheiten.

Rhinoskopie.

Tonsillen.

Uvula.

Adenoide Vegetationen.

Realencyclop. der ges. Heilkunde, by A. Eulenburg, Wien and Leipzig.   Urban and Schwarzenberg, 1880-83; 2nd edition, 1885-87; 3rd edition, 1890.

Die Krankheiten der Nase, des Kehlkopfes und der Luftröhre.
  Annual reviews in Virchow-Hirsch Jahresbericht, Berlin,
  Hirschwald, 1884-1891.
Der Unterricht an der Universitätspoliklinik für Hals- und
  Nasenkranke zu Berlin.
  Klin. Jahrbuch, ii, 1890, p. 140. Centralbl. f. Laryng., 1892,
  No. 3.
Hals- und Nasenkrankheiten.
  Lexis, Die deutschen Universitäten, Bd. ii, 1893.
Untersuchungsmethoden des Kehlkopfes und der Lutröhre.
  Handbuch für Laryng. und Rhinol., by Dr. P. Heymann,
  1897.
Deutsche Zeitschrift f. praktische Medizin.
  Leipzig, 1877 and 1878.
Archiv. für Laryngologie u. Rhinologie, Bd. i-xvii, Berlin,
  Aug. Hirschwald, 1894-1906.
Tukerkulosis.
Zeitschrift für Tuberculose und Heilstättenwesen.

PAPERS PUBLISHED IN JOURNALS.

A.   SCIENTIFIC.

  I. Rhino-Laryngological:
  Demonstration eines Mundspatels u. eines Rhinoscops.
    Berl. klin. Wochensch., 1870, No. 18. (B. M. G.)*
  Demonstration eines Speculum narium.
  Zur medicamentösen Localbehandlung hypertrophischer
    Tonsillen.
    Berl. klin. Kochensch., 1872, No. 8 and 29. (B. M. G.)
  Ein Fall gutartiger Mycosis des Pharynx.
    Berlin. klin. Wochensch., 1873, No. 8 and 29. (B.
    M. G.)
  Ueber laryngoskopische Beleuchtungsvorrichtungen mit
    Demonstrationen.
    Berl. klin. Wichenschr., 1873, No. 27, 29, 31. (B.
    M. G.)
  Zur Kehlkopfbeleuchtung.
    Berl. klin. Wochensch., 1873, No. 50.

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*B. M. G.—Berliner medicinische Gesellschaft.
Laryngol. Ges.—Berliner laryngologische Gesellschaft.

FRAENKEL'S CONTRIBUTIONS TO LITERATURE.

Die laryngoskopische Beleuchtung.
Deutsch. Arch. f. klin. Medicin., Bd. 12, 1873.

Laryngitis haemorrhagica.
Berl. klin. Wochensch., No. 2, 1874.

Erklärung (gegen Böcker).
Berl. klin. Wochensch., 1874, No. 17.

Zur endoskopischen Beleuchtung.
Berlin klin. Wochensch., 1874, No. 18.   (B. M. G.)

Ein einfacher pneumatischer Apparat.   (Vorläufige Mittheilung.)
Centralbl. f. d. med. Wissensch., 1874, No. 47.

Fall von multipler Hirnnervenlähmung.
Berl. klin. Wochensch., 1875, No. 3.

Ein billiger pneumatischer Apparat.
Berl. klin. Wochensch., 1875, No. 19.

Lähmung des recht. Nerv. accesorius.
Berl. klin. Wochensch., 1876, No. 1.   (B. M. G.)

Ueber Beleuchtungsapparate, die ohne weitere Hilfsvorrichtung die Demonstration der Bilder an einem zweiten Beobachter gestatten.
Berl. klin. Wochenschr., 1876, No. 16.

Erwiderung auf den in No. 11 u. 35, dieser Wochenschrift erschienenen Aufsatz des Herrn A. Böcker "Eine einfache Methode, das Bild des Kehlkopfes, etc., einem zweiten Beobachter gleichzeitig zur Ansaunung zu bringen.
Deutsch. med. Wochensch., 1876, No. 41.

Gegen die "Antwort" des Herrn Böcker in No. 48, dieser Wochenschrift.   Eine Duplik.
Deutsch. med. Wochenschr., 1876. No. 51.

Cancroid des Pharynx.
Berl. klin. Wochenschr., 1877, No. 1.   (B. M. G.)

Zur Anwendung der Nasendouche.
Deutsch. Zeitschr. f. prakt. Med., 1877, No. 30.

Die Anwendung der empfindlichen Flamme zur Erkennung der Erkrankung des Stimmorganes.
Berl. klin Wochenschr., 1878, No. 51.

Kehlkopfstenose infolge fehlender Glottiserweiterung bei der Inspiration.
Deutsch. Zeitschr. f. prakt. Med., 1878, No. 6, 7.

Die Anwendung der monometrichen Flamme als Hilfsmittel zur Erkennung von Arkankungen des Stimmorganes.
Deutsch. Zeitschr. f. prakt. Med., 1878, No. 62.

Fall von Mycosis des Zungenrückens u. Pharynx.
Berl. klin. Wochenschr., 1880, No. 18. (Charité Ges.)

Neuere Beleuchtungapparat für geschlossene Lichtleitungen.
Berl. klin. Wochenschr., 1880, No. 28 (Charité Ges.) and No. 42 (B. M. G.).

Zur Rhinoskopie.
Berl. klin. Wochenschr., 1881, No. 3, 7.

Ueber den Zuzammenanhang von Asthma nervosum und Krankheiten der Nase.
Berl. klin Wochenschr., 1881, No. 16.

Ueber die Behandlung der Angina catarrhalis.
Berl. klin. Wochenschr., 1881, No. 47.

Natur und Behandlung der Ozaena.
Referat auf d. internat. Congr. zu London. 1881.

Andwendung des Iodoforms auf Schleimhäuten.
Berl. klin. Wochenschr., 1882, No. 17.

Demonstration einer Modification des Whiteheadschen Mundsperrers.
Berl. klin. Wochenschr., 1882, No. 50 (B. M. G.).

Die Diagnose des tuberculösen Kehlkopgeschwürs.
Berl. klin. Wochenschr., 1883, No. 4.

Discussion über den Vortrag des Herrn Ewald "Ueber das Schlukgeräusch."
Berl. klin. Wochenschr., 1883, No. 52. (B. M. G.)

Eine einfache Methode den Stimmfremitus direkt wahrzunehmen.
Centralbl. f. d. mediz. Wissensch., 1884, No. 10.

Verstellung eines Falles von der Nase aus geheilten Facialiskrampf.
Berl. klin. Wochenschr., 1884, No. 28. (B. M. G.

Ueber Adenoide Vegetationen.
Deutsch. med. Wochenschr., 1884, No. 40.

Ueber die Frage der von der Nase ausgehenden Reflexneurosen.
Trans. of the Section on Laryngology at the International Congress at Copenhagen, 1884.

Inhalationsapparat für aetherische Oele.
> *Centralbl. f. chirug. und orthop. Mechan.*, 1885, No. 1.

Ueber die Anwendung des Cocain.
> *Berl. klin. Wochensch.*, 1885, No. 5. (B. M. G.)

Lanolin als Salbengrundlage für die Schleimhäute.
> *Berl. klin. Wochenschr.*, 1886, No. 5. (B. M. G.)

Angina lacunaris und diphtherica.
> *Berl. klin. Wochenschr.*, 1886, Nos. 17, 18. (B. M. G.)

Eine Knochenleiste auf dem Septum narium.
> *Berl. klin. Kochenschr.*, 1886, No. 24. (B. M. G.)

Erste zur Heilung führende Ausrottung eines Larynxcancroids per vias naturales.
> *Centralbl. f. Chir.*, 1886, No. 24. Beilage.

Demonstration eines Präparates von Larynxoedem bei Nierenschrumpfung.
> *Berl. klin. Wochenschr.*, 1887, No. 27. (B. M. G.)

Erste Heilung eines Larynxcancroids vermittels Ausrottung per vias naturales.
> *Langenbecks Arch.*, 1887, Bd. 34. H. 2.

Vorstellung eines Falles von Kehlkopersipel.
> *Deutsch. med. Wochenschr.*, 1887, No. 20. (B. M. G.)

Perichondritis syphilitica. Demonstration eines Präparats.
> *Berl. klin. Wochenschr.*, 1887, No. 24. (Charité Ges.)

Ueber die submucöse Anwendung des Cocain.
> *Therap. Monatschr.*, 1887, May.

Ueber die Beschaftigungsschwache des Stimmorganes. Mogiphonie.
> *Deutsch. med. Wochenschr.*, 1887. (Verein f. innere Med.)

Ueber das Empyem der Oberkieferhöhle.
> *Berl. klin. Wochenschr.*, 1887, No. 16.

Demonstration eines Präparates (ein ohne Operation Ausgehusteter fibröser Polyp.)
> *Berl. klin. Wochenschr.*, 1888, No. 3. (B. M. G.)

Vorstellung eines Falles von teilweise geheilteer Basedowcher-Krankheit durch Cauterisation der Nasenmuscheln.
> *Berl. klin. Wochenschr.*, 1888, No. 6. (B. M. G.)

Bemerkung zu Remaks Fall von traumatischer Sympathicus-Paralyse.
> *Berl. klin. Wochenschr.*, 1886-8, No. 6. (Dis in the Charité Ges.)

Zur Anatomie der Stimmbänder.

Berl. klin. Wochenschr., 1888, No. 43. (B. M. G.)

Demonstration von Präparaten des normalen Stimmbandes.

62nd Naturforscherversamm. zu Heidelberg, 1888.

Die Behandlung der Pharyngitis chronica.

Therap. Monatscheer., 1888., Nov.

Der Kehlkopfkrebs, seine Diagnose und Behandlung.

Deutsch. med. Wochenschr., 1889, Nos. 1-6.

Demonstration eines Präparates von Laryngitis phlegmonosa bei einer Geisteskranken.

1889, April (Laryng. Gesell.).

Erwiderung auf einen Aufsatz des H. Prof. Bayer in Brüssel "Beitrag zum Studium und zur Behandlung der Empyeme der Highmors-hohle in No. 10 der Deutsch. med. Wochenschr.

Deutsch. med. Wochenschr., 1889, No. 16.

Zur Histologie der Stirmmbänder.

Virch. Arch. Bd. 118, 1889.

Versuche über die Ausfallerscheinungen an der Stimmbänderbewegung bei Abkühllung des nerv. recurrens. (with J. Gad.).

Centralbl. f. Physiologic, 1889, No. 3.

Nachtrag zu dem Vortrag von Küster "Ueber das Empyem der Highmorshohle."

Berl. klin. Wochenschar., 1889, No. 10. (B. M. G.)

Knöcherner Verschluss der Choanen.

Laryng. Ges., 1889, May.

Vorstellung eines Falles von Pharynxstrictur. (Syphilis.)

Berl. klin. Wochenschar., 1889, No. 27. (Laryng. Ges.)

Pathologische Bedeutung der Stimmbänderdrüsen.

Berl. klin. Wochenschr., 1889, No. 43. (Laryng. Ges.)

Die rhinolaryngologischen Operation in der Aera des Cocains.

Deutsch. med. Wochenschr., 1889, No. 51.

Vorstellung eines Falles von Knochenblase (Empyem).

Berl. klin Wochenschr., 1890, No. 22. (B. M. G.)

Demonstration eines Falles von Rachentumor.

(Laryng. Ges.), 1890, June.

Ueber Erkrankung der Oberen Luftwege im Gelfolge der Influenza.

Deutsch. med. Wochen., 1890, No. 28.

Vorstellung eines Falles, ähnlich einer perversen Action der Stimmbänder.

Berl. klin. Wochenschr., 1890, No. 39.   (Laryng. Ges.)

Demonstration eines grossen Rachenpolypen.

Laryng. Ges., 1891, May.

Ueber Veränderungen in den oberen Luftwegen im Verlaufe der Influenza.

Berl. klin Wochenschr., 1891, No. 44.   (Laryng. Ges.)

Photographien mikroskopischer präparate von Kehlkopfsnitten.

Naturforshervers. Halle, 1891.

Demonstration eines Patienten mit Basedowscher Krankheit, die sich nach Entfernung der Rachentonsille besserte.

Verh. d. Laryng. Ges., 1892, Mar. 23.

Demonstration einer exstirpierten Epiglottis.

Berl. klin. Wochens., 1893, No. 13.   (B. M. G.)

Die Demonstration des laryngoskopischen Bildes.

Ther. Monatshefte, 1893.

Der Prolapsus des Morganischen Ventrikels .

Berl. klin. Wochenschr., 1894, No. 26.   (Charité Ges.)

Aphonie durch einen Spalt zwischen den Schildknorpelplatten und dem Ringknorpel nach Tracheotomie. Demonstration.

Berl. klin. Wochenschr., 1894, No. 37.   (Charité Ges.)

Studien zur feineren Anatomie des Kehlkopfes.

1.   Das Stimmbänd, seine Leisten und Drüsen.

Arch. f. Laryng. Bd. I, H. I., 1894.

2.   Der Ventriculus Morgagni.

Arch. f. Laryng. Bd. I. H. 2, 1894.

Der Sogenannte Prolapsus der Morgagnischen Ventrikels.

Arch. f. Laryng. Bd. I. H. 3, 1894.

Demonstration eines Enchondrom des rechten Schildknorpels.

Berl. klin. Wochenschr., 1895, No. 50.   (Laryng. Ges.)

Demonstration eines Nasensteines.

Berl. klin. Wochenschr., 1895, No. 4.   (B. M. G.)

Pachydermia laryngis, ihre Geschichte, patholog. Anatomie und Pathologie.

    Arch. f. Laryng., 1895, Bd. II, H. 2.

Nachtrag zu dem Aufsatz über den Prolapsus des Morganischen Ventrikels im ersten Bande dieses Archivs, S. 369.

    Arch. f. Laryng., 1895, Bd. II, H. 2.

Die keilförmigen Knorpel des Kehlkopfes sind nicht von Wrisberg entdeckt worden und können deshalb nicht nach ihm genannt werden.

    Arch. f. Laryng., 1895, Bd. II, H. 2.

Aseptisches Instumentarium f. Galvanokaustik.

    Arch. f. Laryng., 1895, Bd. II, H. 4.

Die anatomische Nomenclatur.

    Archiv. Laryng., 1895, Bd. III, H. 1 and 2.

Der Eisenbahnschnupfen.

    Arch. f. Laryng., 1895, Bd. III, H. 4.

Die infectiöse Natur der Tonsillitis lacunaris.

    Arch. f. Laryng., 1896, Bd. IV, H. 1.

Tamponträger f. d. Nasenrachen.

    Arch. f. Laryng., 1896, Bd. IV.

Ein Zahn in der Nasenhöhle.

    Charité Annalen, Feb. 22, 1897.

Das Archiv. für Laryngologie.

    Arch. f. Laryng., 1897, Bd. VI.

Die intralaryngeale Behandlung des Kehlkopfkrebses.

    Arch. f. Laryng., 1897, Bd. VI.

Ueber die Bezeichnung Autoscopie, Lamoskopie und Vorschlag des Namens Isthmia für die oberen Luftwege.

    Arch. f. Laryng., 1897, Bd. VI.

Erwiderung auf den Aufsatz des Herrn M. Grossmann: Experimentelle Beiträge zur Posticuslähmung.

    Arch. f. Laryng., 1897, Bd. VI.

Ueber Tracheotomie ohne allgemeine Narcose mit Lokalänesthesie. (Vortrag.)

    Berl. klin. Wochenschr., 1898, No. 23.

Erwiderung auf vorstehende Entgegnung (Kirstein).

    Arch. f. Laryng., 1898, Bd. VII.

Beantwortung der von Herrn Grossmann an ihn gerichteten Frage.

    Arch. f. Laryng., 1898, Bd. VII.

Vortag in der Charitégesellschaft.   ('Trachealfistel.)
Berl. klin. Wochenschr., 1899, No. 15.

L'application par la voie cutaneé de l'ectricité dans les
affections laryngiennes.
*Annales des Maladies de l'Oreille, du Larynx, du Nez
et du Pharynx*, 1899.

Offener Mund und kurze Oberlippe in Folge Straffheit
des Frenulum labii superioris.
Laryng., 1899, Bd. IX.

Bemerkungen über den üblen Geruch aus den Munde.
Arch. f. Laryng., 1900, Bd. X.

Zur Hyperästhesie der Nasenschleimhaut.   (Vortrag.)
Berl. klin. Wochenschr., 1901, No. 15.

Krankenvorstellung.   (Perichondritis cricoidea.)   (Vortrag.)
Berl. klin. Wochenschr., 1902, No. 22.

Pachydermie u. Carcinom nebst Bemerkungen über die
Entwickelung u. die mikroskopische Diagnose des
Carcinoms.
Arch. f. Laryng., 1903, Bd. XIII.

Die Zukunft der Laryngologie.
Internationales Centralblatt f. Laryng., 1905.

Wem gebührt die Priorität der Erfindung der Laryngo-
skopie.
Berl. klin. Wochenschr., 1906, No. 13.

Ein leichter. Reflector.
Arch. f. Laryng., 1903, Bd. XIV.

Schulter-Gaumen-Kehlkopf-Lämung.   (Vortrag.)
Berl. klin. Wochenschr., 1903, No. 21.

2.   Tuberculosis.

Fall von Miliartuberkulose bei einem Kinde mit Tuber-
keln der Choroidea.
Berl. klin. Wochenschr., 1869, No. 11.   (B. M. G.)

Impversuche über Tuerkulose (with Cohnheim).
Berl. klin. Wochenschr., 1868, No. 49.   (B. M. G.)

Die Tuberkulose der Chorioidea und die Miliartuber-
kulose des Kindes.
Jahrbuch f. Kinderkrankheiten, 1869, No. 2.

Experimentelle Untersuchungen über die Uebertrabbar-
keit der Tuberkulose auf Tiere (with Cohnheim).
Virch. Arch., 1869, Bd. 45, S. 216.

Weitere Beobachtungen über Aderhauttuberkulose.
Berl. klin. Wochenschr., 1869, No. 4.

Weitere Beobachtungen von Tuberkulose der Chorioidea.
Berl. klin. Wochenschr., 1872, No. 1.

Ueber die Miliartuberkulose des Pharynx.
Berl. klin. Wochenschr., 1876, No. 46, 47.

Ueber die Färbung des Kochschen Bacillus und seine
semiotische Bedeuting für die Krankheiten der Res-
pirationsorgane.
Berl. klin. Wochenschr., 1884, No. 13, 14.

Bemerkungen zum Vortrag von Herrn Cornet: Prophy-
laxe der Tuberkulose.
Berl. klin Wochenschr., 1889, No. 15.   (B. M. G.)

Ueber die Anwendung des Kochschen Mittels bei Tuber-
kulose.
Berl. klin. Wochenschr., 1890, No. 54.

Demonstration zum Kochnschen Heilverfahren.
Berl. klin. Wochenschr., 1891, No. 3.   (B. M. G.)

Schlusswort zur Discussion über das Kochsche Tuber-
kulin.
Berl. klin. Wochenschr., 1891, No. 8.   (B. M. G.)

Ueber die Wirkung des canthraridinsauren Kali.
Berl. klin. Wochenschr., 1891, Nos. 9 and 10.   (B.
M. G.)

Die Gabbetsche Farbung der Tuberkelbazillen, eine wes-
entliche Modification meiner Methode.
Deutsch. med. Wochenschr., 1891, No. 15.

Der Berlin-Brandenburger-Heilstättenverein für Lung-
enkranke u. seine Heilstätte in Belzig. (Vortrag B.
M. G., Oct. 26, 1898.)
Berl. klin. Wochenschr., 1898, No. 46.

Zur Prophylaxe der Tuberkulose. (Vortrag.)
Berl. klin. Wochenschr., 1899, No. 2.

Vortrag Berl. med Ges. (Tuberkulose), Mar. 8, 1899.
Berl. klin. Wochenschr., 1899, No. 13.

Polikliniken für Tuberkulöse.
*Vortrag Neapler Congress, Münchner med. Woch-
enschr.*, 1900, No. 20.

Das Tuberkulum u. die Früh-Diagnose der Tuberkulose.
(Vortrag.)
Berl. klin. Wochenschr., 1900, No. 12.

Die Tröpfcheninfection der Tuberkulose u. ihre Verhütung.
Zeitschr. f. Tuberkulose u. Heilstättenwesen, 1900, No. 1.

Bemerkungen zur Prophylaxe der Tuberkulose u. die Isolierung der Phthisiken.
Berl. klin Wochenschr., 1901, No. 38.

Polikliniken für Lungenkranke.

Referat erstättet in der Sitzung des Präsidiums des Centralcomites zur Errichtung von Heilstätten für Lungenkranke., Feb. 17, 1901.
Zeitschr. f. Tuberkulose u. Heilstättenwesen, 1901.

Asyle für Tuberkulose.
Zeitschr. f. Tuberkulose u. Heilstättenwesen, 1901.

Entwikelung des Kampfes gegen die Tuberkulose als Volkskrankheit.
Zeitschr. f. Tuberkulose u. Heilstättenwesen, 1903.

Vortrag im deutschen Centralcomite (Tuberkulose), May 16, 1903.

Sanatorien auf Madeira.
Deutsche med. Wochenschr., 1908. No. 48.

Discussion über den Vortrag des Herrn von Helwing über Phthisiogenese u. Tuberkulosebekämpfung.
, *Deutsche med. Wochenschr.,* 1904, No. 6.

Denkschrift über den Stand der Tuberkulosebekämpfung im Deutschland, 1905.

3. *Sundry Scientific Papers.*

Ein Fall von Pyämie in Folge Nekrose der Hinterhauptschuppe durch Zangendruck.
Berl. klin. Wochenschr., 1865, No. 10.

Die Syphillis im vorjährigen Feldzuge.
Berl. klin. Wochenschr., 1865, No. 27, and 1866, No. 15.

Einiges über Gips.
Berl. klin. Wochenschr., 1866, No. 17.

Ueber die Wirkung des Liquor Natri hypochlorosi.
Berl. klin. Wochenschr., 1867, No. 52. (B. M. G.)

Vorstellung eines mikrocephalen Kindes.
Berl. klin. Wochenschr., 1868, No. 50. (B. M. G.)

Bad Friedrichshall.
Berl. klin. Wochenschr., 1869, No. 21.

Demonstration eines Rettungskastens.
   Berl. klin. Wochenschr., **1869, No. 38.   (B. M. G.)**
Herz mit Transposition der grossen Gefässe.
   Berl. klin. Wochenschr., 1870, No. 2.
Zur Sensibilität der Zähne.
   Berl. klin. Wochenschr, 1871, No. 25.
Ueber einen Fall von erblicher Difformität.
   Berl. klin. Wochenschr., 1871, No. 35.
Beobachtung über Vanille-Eisvergiftung.
   Berl. klin. Wochenschr., 1873, No. 51.   (B. M. G.)
Zwei Fälle von Milzbrand beim Menschen.
   Berl. klin. Wochenschr., 1874, No. 22.
Ein Fall von Worttaubheit.
   Berl. klin. Wochenschr., 1881, No. 35.
Angeborener Mangel der mm. Pectorales der rechten
      Seite.
   Berl. klin. Wochenschr., 1885, No. 3.   (B. M. G.)
Mitteilung über Erfolge der Thermometer.
   Berl. klin. Wochenschr., 1886, No. 28.   (B. M. G.)
Demonstration eines Falles von Darmstrictur.
   Berl. klin. Wochenschr., 1888, No. 14.   (B. M. G.)
Gegen Hautwarzen.
   Therap. Monatschr., October, 1888.
Krankenvorstellung Leontiasis ossea.
   Berl. klin. Wochenschr., 1888, No. 44.   (B. M. G.)
Zur Therapie der Aortenaneurysmen.
   Berl. klin. Wochenschr., 1889, No. 18.   (B. M. G.)
      (Dis.)
Zur Entstehung das Alpenglühens.
   Naturwissenschaftl. Rundschan., Vol. VI, No. 51.
Algerien als Winterstation für Kranke.
   Vortrag. Berl. klin. Wochenschr., 1898, No. 5.

B.   PAPERS ON SOCIAL AND PROFESSIONAL MATTERS.

   Die Berliner med. Gesellschaft erklärt, es liegt sowohl im
      Inturesse des ärztlichen Standes, wie auch in dem
      jedes Einzelnen, dass der angehende Arzt sein
      einjährig-freiwilliges Jahr wit der Waffe und nicht
      als Unterarzt abdient, So lange die jetzigen gesetz-
      lichen bestimmungen fur die Militärärzte gelten.
   Berl. klin Wochenschr., 1865, No. 22 (B. M. G.),
      No. 50.

Zur Gewerbeordung.
Berl. klin. Wochenschr., 1869, No. 20.

Zusammenstellung der den Arzt interessierenden Para-
graphen des Strafgesetzbuches für den Nord-
deutschen Bund.
Berl. klin. Wochenschr., 1870, No. 26.

Zur national-ökonomischen Lage der Aertze.
Berl. klin. Wochenschr., 1872, No. 2, 12.

Standesangelegenheiten.
Deutsch. Zeitschr. f. prakt. Medic., 1877, No. 4.

Deutsche Medicinal-Ordung u. Deutsches Arztparlament.
Deutsch. Zeitschr. f. prakt. Medic., 1877, No. 11.

Ein neuer Versuch aerztliche Hilfeleistungen zu erz-
wingen.
Deutsche Zeitschr. f. prakt. Medic., 1877, Nos. 31, 32.

Die Gründung eines Vereins zur Beschaffung guter
Milch in Berlin.
*Vierteljahrbericht f. gericht. Medic. u. öffentl. San.
Wesen.*, 1877, S. 166 u. Supplementheft. 543.

Lebensversicherungsverein für deutsche Aerzte.
Deutsche Zeitschr. f. prakt. Medic., 1877, Nos. 34, 37.

Das Wahlrecht der Aerzte zur Standesvertretung in
Preussen.
Deutsche Zeitschr. f. prakt. Medic., 1877, Nos. 36. 37.

Zur Frage der Lebensmittelfälschung.
Deutsche Zeitschr. f. prakt. Medic., 1877, No. 44.

Die Vorlagen für die Sanitäts-Commission in Berlin.
Deutsche Zeitschr. f. prakt. Medic., 1877, No. 47.

Die Medicinalreform in Preussen.
Deutsche Zeitschr. f. prakt. Medic., 1877, No. 49.

Der Prozess Eulènburg.
Deutsche Zeitschr. f. prakt. Medic., 1877, No. 51.

Der Astley-Cooper-Preis.
Deutsche Zeitschr. f. prakt. Medic., 1877, No. 52.

Bericht über die 50. Versammulung Deutscher Natur-
forscher u. Aerzte in München.
Deutsche Zeitschr. f. prakt. Medic., 1877, Nos. 38, 40,
43, 45, 47. 1878, Nos. 6. 10.

Die 51. Versammlung Deutscher Naturforscher u.
Aerzte in Cassel.
Deutsche Zeitschr. f. prakt. Medic., 1878, Nos. 38, 39.

Bericht über den 5. u. 6. deutschen Aerztetag.
Deutsche Zeitschr. f. prakt. Medic., 1877, No. 30.
1878, No. 32.

Hat die Aufhebung des Pfuschereiverbotes einen Einfluss auf die Versorgung mit Aerzten geubt?
Aerztl. Verinsbl., 1880.

Frequenz der Medicinstudierenden an deutschen Universitäten.
Deutsch. med. Wochenschr., 1881, No. 33.

In Sachen der Disiplinären Beaufsichtigung der Aerzte seitens des Staates.
Deutsch. med. Wochenschr., 1884, No. 36.

Kehrt 200 des greussichen Stafgesetzbuches wieder,
Berl. klin. Wochenschr., 1886, No. 2.

C. OCCASIONAL SPEECHES AND PAPERS.

Militärärztliche Briefe.
Berl. klin. Wochenschr., 1870, Nos. 33, 34, 39, 42, 45;
1871, Nos. 3, 4, 13.

Geschichte der Berliner medicinischer Gesellschaft während der ersten 25 Jahre ihres Bestehens.
Berl. klin. Wochenschr., 1885, No. 44.

Rede bei der Eröffung der Königl. Universitäts-Poliklinik f. Hals u. Nasenkrankheiten.
Deutsche med. Wochenschr., 1887, No. 23.

Einführungvortrag zur Eröffnung der Laryngolog. Section (xii) des internationalen Congresses zu Berlin.

Rudolf Virchow. Seine Tätigkeit in Medic. Gesellschaften.
Berl. klin. Wochenschr., 1893, No. 43.

Die laryngologische Section auf dem internationalen Congress in Rom, 1894.
Berl. klin. Wochenschr., 1894, No. 30.

Prof. J. Gottstein.
Deutsche med. Wochenschr., 1895, No. 6.

Die Enthüllung der Traubebüste.
Berl. klin. Wochenschr., 1895, No. 27.

Prof. B. Brouardel.
Tuberkulosis, 1901.

Der xiv internat. med. Congress zu Madrid in Jahre 1903, u. die Laryngologie.
International Centralbl. f. Laryng., 1901.

Das Mitgliederdiplom f. die Mitglieder des Internat. Centralbüraus.

Tuberkulosis, 1902.

Rede bei der Eröffnung der Hals u. Nasenklinik am., 2 Mai, 1901.

Arch. f. Laryng., 1902.

Robert Koch.

Tuberkulosis, 1902.

Ernst von Leyden und die Heilstättenbewegung zu seinem 70. Geburtstage.

veitschr. f. Tuberk. u. Heilstättenwesen, 1903.

Die Universitätsklinik für Hals-u. Nasenkranke im Charitékrankenhause zu Berlin.

Arch. f. Laryng., 1902.

Manuel Garcia.

Arch. f. Laryng., 1905.

XLVIII.

DISEASES OF THE TRACHEA — ANOMALIES, HEMORRHAGE, INFLAMMATIONS AND INFECTIONS.*

By James E. Newcomb, M. D.,

INSTRUCTOR IN LARYNGOLOGY, CORNELL UNIVERSITY MEDICAL COLLEGE.

NEW YORK.

In opening the discussion on tracheal diseases, it is very evident that we must place some arbitrary limit on that portion of it assigned to the speaker. Otherwise there would be no limit to what might be properly presented. This reservation must be the excuse for the omission of much pertinent material.

At the outset, a plea is made for a more thorough examination of this structure by means of the laryngoscopic mirror than is often, and in fact usually, made. The introduction of the tracheoscope has by no means eliminated the utility of the mirror. Our fathers in laryngology learned much from its careful use in this direction, and, as is the case with all technical procedures, practice makes perfect. It is interesting to note the remarks of Morell Mackenzie on this point. Thus, he tells us, he was able to get a good view of the trachea in only thirteen of his first 100 hundred cases, in his second 100 of twenty-one, in his third of twenty-nine and in his fourth he was able to see the bifurcation in forty-seven. Our necessities are a good light and a somewhat higher position of the patient than we employ for laryngoscopy. The patient's head should be inclined slightly forward with the neck stretched, but without any upward tilting of the chin. The mirror should be held more horizontally than for laryngoscopy, and a still more horizontal position enables us to

trace the tracheal wall upward from the bifurcation. The upper third of the posterior wall often eludes our vision by any method.

A lateral tilting of the glass brings the corresponding walls into view. Türck thinks that pressure on the tube from without may assist in this particular. It is sometimes of advantage to have the patient sit sideways on a chair and then rotate the head so as to face the examiner.

ANATOMY.—No particular advances have been made in our knowledge during the last few years. Zuckerkandl declares that the general statement that the trachea increases in width from above downwards is not true. In fact, he found the opposite to be the case in two out of four cases examined with reference to this point. It has been shown that islands of ciliated epithelium exist between areas of pavement epithelium. The vasomotor apparatus of the upper portion, in dogs at least, receives innervation through the superior laryngeal nerve, while the inferior sends fibres thoughout the entire tube. One case of diverticulum has been reported (Czyhlarz) due apparently to a local deficiency of elastic and muscular fibres. The tracheal axis does not always coincide with the median line of the body. The surgical significance of this fact is obvious. Low down on the left wall a pulsation is usually observed and is referred to the underlying pulmonary artery. The deviation from the normal axis suggests often that some compression may be present. As contrasted with pathologic conditions, it may be said that in the latter the parts are more congested, so that the distinction between the rings and pars membrana is lost. Moreover, changes in the patient's position and in the angle of the mirror will generally clear up all doubt. Finally, in spite of the apparent narrowing of the lumen, there is no dyspnea.

MALFORMATIONS.—Semon has reported the case of a girl with the trachea bent just below the larynx from right to left, but in the opposite direction lower down so that at the site where one would look for the bifurcation there seemed to be some influence on the outside pressing the tube inward. A strong pulsation was noted at this point. Several cases of tracheocele have been reported in the last ten years. These may arise from persistence of the branchial clefts or from

pathologic changes. They are generally amenable to operative treatment. Most of them are small and have existed years without symptoms. Gregor mentions the case of a child of five months with symptoms of tracheal stenosis, proving fatal. Autopsy revealed an hour-glass contraction at the middle of the tube, the pars membrana being lacking at this point.

INFLAMMATIONS. — Perichondritis occurring about the trachea is generally secondary to typhoid fever, tuberculosis, syphilis or other infection. The rings are often bared and may be thrown off in pieces of various sizes. Naturally the tube contracts somewhat after this accident. Chronic perichondritis is a possibility, but is generally masked during life by symptoms referable to superjacent lesions. It occurs most frequently from scleroma, but has been ascribed to simple chronic catarrh. Irregular thickenings of the cartilages may start on a small area and spread through the submucosa, forming flat plates parallel to the rings. Ecchondroses may extend to the upper bronchi, and such have been noted during life. Ulcerations may occur in the trachea from intubation tubes. One interesting and unique case of erythema nodosum has been reported. The patient had a sudden attack of dyspnea necessitating tracheotomy. Recovery followed. Other dermatoses which have been noted in the trachea are herpes, impetigo herpetiformis, pemphigus, lichen ruber, erythema multiforme and angioneurotic edema. There is nothing to add under the latter heading to the comprehensive thesis presented last year by Halsted. Interesting observations have been made by Folina of the effects on rabbits' tracheal mucosa by complete nasal obstruction. The first lesion is the strong vascular congestion with destruction of the vessel walls and their consecutive confluence; then follow destruction of the epithelium, infiltration of the submucosa and disappearance of glands. Later the epithelium reforms, but the vessels remain shriveled, while the submucosa reduces itself to a very delicate layer, scarcely recognizable.

Acute catarrh is generally associated with that of the larynx and bronchi. It may be propagated from the nose and nasopharynx or from below upward. The general causes of bronchial inflammations apply equally well to the trachea. In fact, in many cases of so-called bronchitis, the inflammation hardly extends below the bifurcation. The

symptoms of an attack need no enumeration here. Considerable swelling of the mucosa can occur without dyspnea. The amount of expectoration depends on the area of mucosa involved. The latter may take on a purplish hue. Ulcers may occur on the intercartilaginous portions. Mucus may remain adherent at one spot for several days and be mistaken for ulceration. Years ago, A. H. Smith of New York reported one case in which the trachea was lined with a plastic deposit which underwent a low degree of organization and became tough and fibrous like an old pleuritic adhesion. A laryngo-tracheotomy was done, but a complication of measles, interstitial pneumonia and diphtheria proved fatal. Sestier has reported two rather doubtful cases of primary tracheitis, the sequel being edema of the larynx. Phlegmonous inflammation almost always comes from the larynx or esophagus. Acute abscess is a great rarity. Chronic catarrh is a sequel of the acute or occurs as a part of chronic bronchitis in old people. The treatment of catarrhal conditions is essentially that of the accompanying bronchitis. There seems to be a greater conviction that creosote inhalations check secretion.

A word may be added referring to the occurrence of dysphagia as a symptom of tracheal inflammation. Years ago, Hyde Salter called attention to the fact that while the lower extremity of the trachea is fixed, the upper part rises with the larynx in the act of swallowing. The pain is most severe when the elevators of the larynx act most vigorously during this function, that is, when the chin is raised; whereas, if the chin is pressed against the neck so that these muscles cannot act with force, little or no pain is felt. Morell Mackenzie, however, records that he never saw this symptom present, and Salter's theory was not confirmed by laryngoscopic examinations.

Inasmuch as tracheal injections figure largely in modern therapeutics, a few words may be devoted to two new methods which have been brought forward. The first is that of Mendel, who says that if the tongue is held ouside the mouth as in ordinary laryngoscopy and the patient refrains from swallowing, the pharynx forms a funnel, the only inferior outlet of which is the glottis, for the gullet opening is closed except during swallowing so that a small quantity of liquid projected against the wall of the pharynx runs down into the air passages. This he styles the "median" method. He

prefers, however, the "lateral" method described as follows:
The curved canula is passed with its convexity firmly applied
to the base of the left faucial pillar used as a support. The
nozzle rests horizontally in the glosso-epiglottic groove and is
hidden by the base of the tongue. The contents of the syringe
are then discharged against the opposite pharyngeal wall with
sufficient force to carom, as it were, around it and thus reach
the posterior wall, whence they drop into the larynx.

Marangos injects through the nose. He denies that all of
the injection by the Mendel method reaches the trachea. The
fluid goes down not merely by its own weight, but is drawn
down by inspiration. He passes the tube of the syringe through
the nose so that the free end just clears the soft palate. In
the adult from 12 to 15 c.c. of fluid may be used. The patient
breathes normally with the head thrown slightly backward
and the fluid is discharged drop by drop, synchronous with
inspiration, the discharge being occasionally suspended. The
patient can in this way inject himself. Marangos favors the
use of gomenol with a little cocain.

TRACHEAL OZENA.—During the last decade, no small num-
ber of cases has been reported in which an ozena was present,
not only in both the nose and trachea, but also in the trachea
alone. There is no doubt that this process may be a primary
one in the air tubes. We must distinguish these cases from
a simple chronic, dry laryngo-tracheitis by their chronic course
and fetid crusts. The source of the odor is still a matter
of dispute. Fraenkel, who was the first to describe tracheal
ozena, referred the odor to the disappearance of Bowman's
glands and their secretions. Zaufal referred it to an abnormal
widening of the air passages. Both of these theories originally
suggested with reference to the nose have been opposed by
Zarniko and Baginsky. Grünwald has suggested the idea of
a substratum of keratosis of the pavement epithelium. The
latest idea advanced by Löwenberg and Abel is that the coccus
known by the name of the former is not identical with the
bacillus of Friedländer, and is not the cause of the disease
itself, though it may be the cause of the characteristic odor.
As far as we know, there is no reason to doubt the essential
identity of the lesions in the nose and trachea. The tropho-
neurosis theory has had a recent resurrection. On this basis,
there first results a disturbance of nutrition, though no one

can account for the peculiar sequence of events. A meta-
plasia of the epithelium follows with keratosis, superficial in-
flammation, crust formation and then through the inhalation
of a certain organism (possibly Löwenberg's) the fetor. In
one instance a pseudo-tubercular bacillus was found, although
the sputa from the same case were negative. A few cases
have been recorded in which the crust formation was so abund-
ant as to threaten life. The possibility of using the trache-
oscope in their removal under such circumstances has been sug-
gested. There is some danger of pushing them down in try-
ing to dislodge them. Tracheotomy has been done in one
instance by our colleague, E. J. Moure. In one instance the
crusts formed a blackish viscous layer reaching down to the
bifurcation. Remedies suggested are menthol inhalations and
injections, injections of watery solutions of naphthol, appli-
cations of phenol sulforicinate in 30 per cent solution, injec-
tions of guaiacol in albolene, etc. Frequently the mucosa of
the trachea becomes quite insensible and this favors the ap-
plication of mechanical measures. The accessory sinuses must
not be overlooked in our efforts to clear up obstinate cases.

One remarkable case may be summarized. It is reported
by Dupond and occurred in the hospital service of E. J. Moure.
A sailor was admitted suffering from laryngeal dyspnea. The
left cord was immovable in the median line, the right moved
slowly. Nasal ozena was found. During the laryngeal exami-
nation, the cords moved suddenly and crusts were seen in
the trachea. Expectorant measures were ordered, but before
they could be used the man expelled a mass of crusts the
size of a pigeon's egg. Accumulation had led to a diminu-
tion of laryngeal sensibility owing to the impairment of the
sensory nerves by the atrophic process; hence the absence
of a greater severity of symptoms. Respiration was labored,
wheezing and noisy. The voice was low and husky. Under
a short course of benzoate of sodium internally and sulphur
inhalations the man spoke and breathed freely, other masses
having been expelled. Dupond believes that the process ad-
vances with greater rapidity in the trachea than in the parts
above, owing to its greater size and its rigid walls which in-
crease the difficulty of expulsion of the crusts and thereby
favor their stagnation and decomposition.

A few cases of inflammation have been ascribed to the ef-
fects of drugs taken internally. Thus Réthi has reported one

case of laryngeal and tracheal inflammation in a patient taking Fowler's solution, dose not stated. The symptoms subsided immediately on the withdrawal of the remedy.

TRACHEAL HEMORRHAGE.—During the last few years, an interesting series of cases has been placed on record under the varying designations of hemorrhagic tracheitis, hemorrhagic tracheal catarrh, tracheal hemorrhage, etc. The most striking feature about them is that, in fully one-half the cases, the existing cause has been regarded as influenza. Nearly all of them have occurred in young adults or in persons approaching middle life. They have been about equally divided between the sexes. Considering the prevalence of influenza during the last fifteen years, such cases are probably more common than reports would lead us to believe. Many physicians have seen cases of hemoptysis in which the lungs, so far as could be determined by our present methods of examination, were healthy and which upon the cessation of the bleeding have been dismissed, while the exact cause of hemorrhage has remained a mystery. It is easy to dismiss the question by saying that such cases have been those in which the bleeding could be regarded as one expression of the hyperemia which is so often the first manifestation of the pulmonary tubercle, so that the diagnosis has not been easy, but too many of them have been kept under observation for a long time to make one believe that they do not deserve a separate classification.

In nearly every case, there has been a history of more or less recent influenza and of more than one attack. There has been a tickling irritation in the lower throat and the sensation as of a foreign body. There has been a short dry cough, the more intense the more recent the influenza. Unless the latter malady has been still evident, there has been no rise in temperature, and such rise if present has been slight. Certainly the charts have presented none of the features of incipient phthisis. The bleeding has come on suddenly and has been repeated at intervals of hours, days and even months, but in the event of repetition there has usually been a recurrence of the influenza. As a rule, but two or three ounces of blood have been raised; in one or two cases there has been a true bronchorrhagia. Some have emaciated, but this may have resulted from the initial disease. Examination of the chest has given no evidence of involvement of the pul-

monary parenchyma. Occasionally, in examination of patients
with recent influenza, there may have been a few moist rales
and even traces of broncho-pneumonia. There has been a distinct
absence of the classical signs of incipient tuberculosis. Bacilli
have been absent, but this finding has had, of course, only
the same relative positive and negative values as under ordinary
circumstances.

The laryngoscope has brought to light a peculiar condition
in the mucosa of the upper trachea, best seen if the examina-
tion has been made just as the bleeding has been passing
off. If we examine the trachea during an ordinary subsid-
ing hemoptysis, and are fortunate enough to secure a good
view, we generally find it lined with clot or clot patches
throughout its entire length. In many of the cases referred
to, it has been possible to get a view way down to the bifur-
cation, and the lower portion has been found entirely clear.
The lesion has been confined to the subglottic portion. It has
consisted, to use a single descriptive phrase, of a varicose con-
dition of the tracheal vessels. In all the cases reported, this
definite view has been obtained. At times the vessels have
been seen running parallel to the tracheal rings, or perhaps
converging toward the subglottic area or irregularly scat-
tered like small leeches over the upper tracheal wall, and blood
has been actually seen oozing from them. Rest, opium and
ice pellets have been of service in treatment, and an astringent
spray has toned up the vessels, while tonics as strychnin,
cinchona, etc., have completed the cure in uncomplicated cases.

As regards the direct relation of influenza as an etiologic
factor, we must remember that this region is among those
affected, and primarily so in pretty much every case of the
disease. We know that this region is very vascular, and it
is just at this point that the impact of respiration, phonation
and cough converges. Considering then the local diminution
of resistance and the systemic weakening of the influenza, it
is natural that such a condition as that described should be
brought about. It may follow from other causes than this
special infection. In one instance it seemed to be the initial
manifestation of cirrhosis of the liver.

It is only fair to note that some of these cases, in which
tracheal varices have occurred, have later passed on to the
category of full-fledged cases of pulmonary tuberculosis, so
that considerable time must elapse before we are sure of our

position in a given case. Therefore, we must admit that while tracheal hemorrhage may exist independently of pulmonary disease, it may be present also as a distinct lesion in persons who later develop lung disease. In all the cases reported under the classification, a most careful search has been made for tubercle, but none has been found except in those which have passed on to tuberculosis as above specified. Two reflections are pertinently suggested by the author, who has reported the largest number of cases. The first is that greater reserve is necessary in making a diagnosis of pulmonary tuberculosis in patients who have bleeding, emaciation, slight fever and suspicious chest signs; the second is that some cases regarded as cured incipient tuberculosis may have been only recoveries from tracheal bleeding as a sequel of influenza.

TUBERCULOSIS.—In an excellent paper by our colleague, Dr. Jonathan Wright, on Tracheal Syphilis, published in 1891, he discusses among other topics that of differential diagnosis from tuberculosis, quoting Vallette as saying that "tuberculosis of the trachea is usually only a feeble episode in the laryngeal and pulmonary trouble which it accompanies." This expresses, for nearly every case, the true state of affairs. In fact, Wright refers to one case of Vallette's as the only one he could find in which the trachea alone was affected. I have gone over the literature of the subject since the date of Dr. Wright's paper, and have been able to find notes of three additional such cases. One of these is reported by Hansemann, who found, on autopsy on a woman of 73 years, tuberculous disease of the trachea from the bronchi up to the larynx, but no trace whatever of tuberculosis in other tissues. In the discussion of this case, Schmorl related the histories of two others with the same limitation of lesion. One was found in a man dying from typhoid fever, the other in a child of 8 years, the exact cause of death not being given. Cases with coincident involvement of the larynx and bronchi are matters of daily occurrence. Tracheal ulcerations here are more marked on the posterior wall and are often found in advanced cases when the patient becomes bedridden. This is doubtless due to the long-continued contact with the mucosa of a tenacious agent such as bacilli-laden sputum. Naturally, from proximity, the upper portion of the trachea suffers more than the lower. The pathologic changes present no peculiarities. The tube is generally

thickly coated with mucus, though it may not be produced at this site. The ulcers are generally chronic, but may run an acute clinical course, fuse and become of considerable size. In one of Schrotter's cases, the entire surface from the sixth ring to the bifurcation formed one large ulcer. Ulcerations may penetrate the wall of the tube, but unless they do so, they add no special symptoms. A view of the trachea is often impossible, owing to the swelling of the laryngeal structures. When the former becomes infected in its lower parts, such infection probably comes from the bronchial glands. Weichselbaum saw one case, in which perforation took place into the trachea and esophagus from extension from the glands named. Schrötter has seen cases of involvement of the upper portion of the tube, which he could explain only on the same theory of infection from the glands.

No enumeration of the features of tuberculosis of the trachea should omit reference to the rare tuberculoma first described by our associate, Dr. J. N. Mackenzie, nearly twenty-five years ago. I am greatly indebted to him for an interesting personal communication giving his own experience in this direction. Several other cases purporting to be similar have been reported, but the majority of them have either been wrongly classified or the evidence adduced in their favor is not convincing. By the term used, Mackenzie refers "not simply to a lesion containing the bacillus, but to a distinct definite characteristic tumor-formation covered by unbroken epithelium and consisting of a mass of miliary tubercles set in a vascular network of connective tissue and exhibiting all grades of tubercular degeneration up to cavity formation." It will be observed that this condition is sharply defined from mere moundlike infiltrations. In the communication referred to, Dr. Mackenzie states that he has seen, in all, three cases in which the diagnosis was established microscopically beyond a doubt, and two others in which no histologic examination was made. To these rigid standards, the loose statements of several other writers do not conform and their diagnoses of their respective cases cannot be accepted, still less their claims to have been the discoverers of the condition.

SYPHILIS.—The following may be enumerated as the specific lesions which may involve the trachea: catarrhal inflamma-

tion, erythema, condyloma, gummi, ulceration, perichondritis and cicatrices. Catarrhal inflammation has no special appearance or symptoms and a diagnosis of such as a specific manifestation could be made only in the presence of other and conclusive evidences of this infection. Of the so-called secondary infections, erythema and condyloma are rarely observed, probably because they are overshadowed by the extreme changes in the larynx. Erythema might cause irritation, but no symptoms would arise from condyloma until ulceration occurred. In one case reported by Harrison Griffin, a broad projecting granular mass was visible upon the anterior wall immediately under the cords, running backward about an inch and causing considerable narrowing of the lumen. It was of a reddish color with a skin-like secretion. It had sharply defined limits and its upper surface was irregularly fissured. Under the internal use of the iodids and inunctions over the thyroid cartilage it disappeared in three weeks. Condylomata are not always reddish, but sometimes appear as white spots or as thickenings with superficial ulcerations.

Circumscribed gummata are rare, especially in the upper portion of the tube. Parker has reported the case of a boy of 15 years with inherited syphilis who, on autopsy, showed dense fibrous tissue in connection with the mucosa and submucosa. At one point, the lumen was reduced to a diameter of one-quarter of an inch. Tracheotomy had been done and the fistula closed later. Death resulted from catarrhal pneumonia. The effects of the inflammation began somewhat abruptly, one and one-half inches above the bifurcation, and increased downward. Extreme interstitial inflammation compressed both bronchi and alveoli. The smaller tubes and alveoli were full of fetid pus. Beale notes that such forms of obstruction always occur at the lower end of the tube. Gerhardt explains this localization by the fact that the lower parts are more liable to injury by cough and by the additional fact that the pulsations of the pulmonary artery always keep the tracheal wall in a constant state of vibration. Next in frequency, as to site of lesion, is the upper portion, by direct extension from the larynx.

Infiltration may come on years after the body has been free from a syphilitic lesion. The process seizes on the cartilages and leads to inflammation and necrosis. If not treated, we have the usual sequence of softening, ulceration and de-

struction. Infiltrations are often ring-like. Membranes are more rare than in the larynx from the same cause. Here may be cited the remarkable case described in the candidate's thesis of our president, Dr. Gleitsmann, presented to the association in 1880. His patient was a woman of 32 years who presented along with various other lesions the "seeming appearence of a second glottis far below the normal one. Two dark red symmetrical membranes ran horizontally from back to front of the trachea, with a very small longitudinal opening between them, which was wider posteriorly than anteriorly. They remained immovable during respiration and phonation, and were localized in the region of the fifth or sixth tracheal cartilages. Their surfaces and free margins did not show any signs of ulceration. It was impossible to determine their vertical thickness." Under systemic and long-continued treatment these adventitious bands entirely disappeared.

With a desire not to trespass on the ground of other participants in this discussion, I omit reference to the various contractions and stenoses which may result from specific disease. Ulcerations sometimes lead to deplorable results. Diffuse peritracheal and bronchial syphilomata have been noted. The clinical aspects of these various lesions are modified by the fact that the bronchi and lungs are often synchronously affected. Various forms of paralyses are simulated by the results of pressure and contraction. Downie declares that hereditary syphilis is more often the cause of ulcerations here than is acquired disease. The symptoms comprise in varying combination hemoptysis, cough, dyspnea and stridor. Often the cough and sputum suggest tuberculosis, the breathing and respiratory spasm, laryngeal stridor. Ulceration may perforate the aortic arch. In a general way infiltration and gummata give no symptoms until narrowing of the lumen occurs. Ulcers may cause cough and pain. Sputa are mucopurulent and purulent. In the latter stages of infiltration we have reaction in neighboring parts. Rings and membranes give evidences of stenosis. In marked stenosis we have fever and symptoms of pneumonia.

The diagnosis is generally easy. The systemic history is taken into account, and a careful examination should be made of the entire body for stigmata of syphilis. If the larynx is free, examination is generally easy, because it opens widely and the epiglottis is instinctively elevated. Involvement of

the larynx often precludes a view of the trachea, and the diagnosis must be then made by exclusion. Here, as elsewhere, the iodid often clears up many obscurities.

Differential diagnosis is called for from tuberculosis, scleroma, ulcers of other varieties, tumors and foreign bodies.

Scleroma generally begins in the nasopharynx and spreads downward, generally affects a large area, has no ulcers and runs a long course, even over decades.

In tuberculosis, we almost always have ulcers in the larynx and we are helped by the results of chest examinations and by the finding of bacilli in the sputum. Tuberculin injections may solve the problem.

Of tumors, the most common are fibromata and papillomata. Glandular masses and malignant disease resemble gummata.

Foreign bodies are often overlooked because covered with granulations.

The treatment is that of the specific disease in general, together with such topical applications and mechanical measures as the individual case may demand. H. von Schrötter has recently employed the tracheoscope in one case for locating a specific lesion which was found at the bifurcation and was removed by internal medication, as was verified by subsequent examinations. He warmly commends the use of this instrument in order to make the diagnosis and treatment more accurate.

As a practical matter, it may be observed that it is hard to separate syphilis of the trachea from an accompanying lesion of the bronchi. Reference may be made here to the valuable paper of L. A. Connor in 1903 on Tracheal Syphilis. His statistics are of interest. He has analyzed 128 cases recorded in literature and occurring in his own practice, finding that twenty of these were gummata, fifty-one ulcers, while of endotracheal connective tissue new growths, distinct scars were noted in forty-seven and diffuse thickenings in thirteen. Fibrous peritracheitis was present in eight. The trachea alone was involved in 56 per cent, trachea and bronchi in 33 per cent and the bronchi alone in 11 per cent.

Out of Connor's 138 cases there was a mortality of 76 per cent. Of fifty-eight cases in which the immediate cause of death was given, nineteen died from pneumonia, four from perforative hemorrhage, eleven from sudden paroxysmal

dyspnea and the remainder from gradual exhaustion. Of twenty-nine rationally treated, fifteen were cured, eleven improved, while but three failed to respond to treatment.

A word may be added concerning scleroma. Inasmuch as the programme for to-morrow contains a paper on this subject, which will be thoroughly dealt with, no reference is made here to the histology of the disease. Suffice it to say that while its occurrence in the trachea is generally secondary to that in areas above, it may here occur as a primary lesion. According to the stage to which it has progressed, we have dyspnea, crust accumulations, cough, scarring and stenosis. There is no specific treatment. Symptoms must be met by suitable measures which embrace inhalations, mechanical removal of crusts and infiltration deposits, and the various surgical measures which are proper for stenoses from other causes.

XLIX.

TUMORS OF THE TRACHEA.*

By Clement F. Theisen, M. D.,

CLINICAL PROFESSOR IN DISEASES OF THE NOSE AND THROAT, ALBANY MEDICAL COLLEGE.

ALBANY.

Bruns, in his very complete article on the neoplasms in the air passages (trachea), states that the first observation of a tracheal tumor was in 1767, by Lieutaud. The patient in whom it was observed, a boy, died of a sudden attack of dyspnea, and a polyp with a long pedicle, which had been carried into the glottis by the air current and had caused the sudden death, was found. After the introduction of the laryngoscope, the reports of tracheal tumors became more frequent.

Türck, in 1861, was the first to observe a tumor in the upper part of the trachea in the laryngeal mirror. After him, cases were reported by M. Mackenzie, Schrötter and Störk. This rare occurrence of tracheal tumors is in great contrast with the frequency of laryngeal tumors, as Semon, in 1889, collected over 10,000 cases of benign laryngeal neoplasms (Bruns). According to these figures, tracheal new growths as compared to those occurring in the larynx, would be less than 1 per cent; or, in other words, the relation would be approximately 100 laryngeal growths to 1 in the trachea.

Bruns' personal observations are somewhat different, as he observed 300 laryngeal growths to 7 in the trachea.

Moritz Schmidt, out of 42,635 cases of diseases of the upper air passages, observed 2,088 new growths, of which 748 were laryngeal, and only 3 tracheal.

Bruns states that the slight tendency of the trachea to the development of new growths may be explained by the fact, that the trachea, which is a simple, rather rigid, smooth tube, has practically only the passive function of the passage of air, while

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*Read before the American Laryngological Association, May, 1906.

the larynx has a complicated structure, and such a function that its parts are in almost constant motion. This also explains, perhaps, the slight tendency of the trachea to primary catarrhal inflammations, and the fact that the majority of tracheal tumors are in the upper part of the trachea, and the smallest number in the middle, because particularly this part of the trachea is so well protected from irritation of all kinds.

In order to study the subject, the statistics of the different writers had to be consulted. The valuable theses of Müller (3), Koch (1), Orth (4), Schrötter (5), Lemoine (7), Scheuer (6) and Bruns' monograph (8), were of great assistance in preparing this paper. Many of the original reports of cases were also consulted. J. Solis-Cohen's paper (18), in Ashhurst's Encyclopedia of Surgery, was also of great value.

Granulation tumors resulting from tracheotomies and the wearing of tracheal canulas, and the syphilitic or tuberculous granulomata are not considered genuine tumors, and are not included in this paper. The writer's paper is based on a study of most of the authentic cases of primary tracheal tumors in the literature, one hundred and thirty-five cases in all. Other cases have been reported, but in some of them there was some doubt of the diagnosis and in others the data were insufficient.

Of the 139 cases, 85 are benign and 46 malignant.

BENIGN NEOPLASMS.

The benign new growths occurring in the trachea are about the same as those observed in the larynx. The following varieties occur in the trachea: The fibroma (polypus, fibrous polypus), the lipoma, the papilloma, the ecchondroma and chondroosteoma, the adenoma, the intratracheal goitre or struma and the lymphoma. Of the malignant neoplasms, only the sarcoma and carcinoma have been observed occurring primarily in the trachea.

INTRATRACHEAL STRUMA.

Considering first the benign growths, we find that the intratracheal struma is one of the rarest as well as one of the most interesting forms.

Cases of intratracheal struma have been reported by Ziemssen (73), Bruns (74), Heise (75), Roth (77), Paltauf (78), Baurowics (80), Freer (81) and Theisen (82).

Three cases, those of Neumayer (7) and Frankenberger (72), reported as cases of struma, have not been included in this list, because the diagnosis was not proved in any of the cases.

Abstracts of the reported cases of intratracheal struma will not be given, because they were published in the writer's original paper, "A Case of Intratracheal Colloid Struma—Operation," in the *American Journal of the Medical Sciences,*
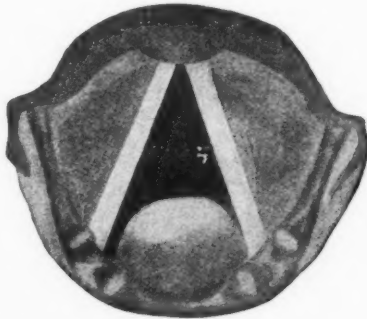
Fig. 1. Writer's case. Intratracheal struma.

June, 1902 (82). A full report of the writer's case was published at that time, with the histologic diagnosis, which was "colloid struma originating in thyroid tissue situated beneath the submucosa of the trachea."

It may be of interest to mention at this time, that the tumor, which was removed by tracheo-fissure Nov. 16, 1901, and which extended downwards along the posterior wall of the trachea from the first ring for a distance of 5 cm., has not returned. I examined the patient a few months ago, and found the trachea clear with the exception of a little thickening where the tumor had been attached to the tracheal wall. Fig. 1 shows the tumor as it looked on laryngoscopic examination, and Fig. 2 shows a drawing of a section, low power.

As the etiology of this class of benign intratracheal growths has been so well studied, I will consider it rather thoroughly. Up to the time of Paltauf's investigations (78) it was, however, rather obscure.

The two theories as to the origin of this most interesting form of tumor that have received the most consideration, are those of Bruns (79) and Paltauf. Bruns and Heise, the chief exponents of the embryonal theory, held that in intrauterine life a small accessory thyroid lobule from aberrant embryonic rudiments of the thyroid gland (Angeborene Verlagerung von

Fig. 2.   Drawing of Section.   Low power.

Schilddrüsengewebe) must have, in such cases, been present in the fetal larynx or trachea. This lobule, developing about the time of puberty, resulted in the true intralaryngeal or tracheal so-called "accessory thyroid tumor." Paltauf was able to prove in his case, by microscopic examination, that this theory was not tenable.   In his case, there was a connection between the intratracheal growth and the thyroid gland externally. The thy-

roid was so firmly attached to the cricoid cartilage and upper three tracheal rings, that it could not be separated from them. The space between the cricoid and first tracheal ring, and a portion of the external lateral lobe of the thyroid, which was firmly adherent to the cartilage at this point, were examined microscopically, and he was able to prove positively that the thyroid tissue had penetrated (through the interstitial membranes) to the perichondrium and submucosa on the inner surface of the trachea, the cartilage itself remaining intact. This observation of Paltauf's is the first instance on record of normal thyroid gland tissue penetrating to the interior of the trachea, although Orth (86), in his Pathological Anatomy, makes the statement "that strumas, but particularly malignant neoplasms, could penetrate into the air passages."

Paltauf's conclusions, that these tracheal tumors springing from thyroid tissue do not owe their origin to an intrauterine deposit of thyroid tissue, are of great interest. They should, therefore, not be called accessory thyroid tumors. They originate in extrauterine life by penetration of the gland tissue between the cricoid and thyroid cartilages, between the cricoid and first tracheal ring, between the upper tracheal rings and through the interstitial tracheal membrane itself, from without. When this occurs, it should be considered as a direct extension of an enlarged thyroid gland—a parenchymatous struma. Proof of this assertion is that the thyroid gland has really grown fast to the cricoid cartilage, interstitial membranes and upper tracheal rings. This abnormal adhesion can neither be explained by pressure nor by an inflammatory process, but can have occurred only during the formation and development of the thyroid gland, and only in the way that the fetal gland, in these cases, must be united with the perichondrium of the cartilage and the interstitial membranes.

Gruber's investigations (83), perhaps, would give additional support to Paltauf's theory. He found, after examination of many Russians and Bohemians, that there was often an accessory or really an extra lobule, extending downward from the lowest posterior margin of the lateral lobes and lying very close to the trachea. These extra lobules may also lie in the crico-thyroid space. The only parallel cases that possibly give some support to Bruns' theory are those observed by Streck-eisen (87). He found on sections through the hyoid bone seven times the so-called glandulæ intrahyoideæ; that is, thy-

roid tissue was shut in the bone. He believes that this was shut in during the ossification period.

In my own case, it could not be determined during the operation whether the left lateral thyroid lobe, which was enlarged, was adherent to the trachea or not. The isthmus was not, because, in ligating it, the ligatures could be passed readily between it and the trachea. It is a rational deduction, however, from the fact that the intratracheal growth was really part of the tracheal wall, and springing as it did from the posterior and left lateral wall, that in this case, too, the intratracheal tumor was really an offshoot from the left lateral thyroid lobe.

An analysis of ten cases of this class of tumors brings out a number of interesting points: (a) The location of the tumors in all the cases, with the exception of Bruns' last case, was characteristic. They were all situated in the lower part of the larynx and upper part of the trachea and attached to the lateral and posterior walls. Bruns' last case was the only exception to this rule, the growth being attached to the anterior wall. (b) This point decides another interesting fact before mentioned, that these tumors, for this reason, should not be called accessory thyroid tumors, because they are really offshoots from the thyroid, as proved in the majority of the cases by the adhesion of the thyroid to the tracheal wall, and in Paltauf's case, microscopically, by the infiltration of the interstitial membranes with the follicles .of the thyroid gland. (c) They were all observed early in life, from the fifteenth to the thirty-third year, with the exception of Roth's case (77) (the fortieth year). (d) A goitre of moderate size was present in all except in one of Heise's and in Freer's case. (e) They occurred in both sexes—three in males and seven (including the author's) in girls and young adult women.

PAPILLOMATA.

The tracheal papilloma is one of the commonest benign tracheal growths, and usually occurs together with multiple laryngeal papillomata. The majority of the cases of tracheal papilloma occur in children.

Six of the recorded cases of tracheal papilloma are undoubtedly congenital, because the children were hoarse and there was dyspnea from birth.

Bruns has found the same to be true of laryngeal papilloma

in children, about one-fourth of the cases being congenital. (Bruns, P. Die Laryngotomie z. Entfernung intralaryngealer Neubildungen, Berlin, 1878, S. 179.)

Cases of tracheal papilloma have been reported by Davis Colley (11), Maissonneuve (10), Bruns (9), Schrötter (12), M. Mackenzie (13), Labus (15), M. Mackenzie (14), Butlin (16), Labus (17), J. Solis-Cohen (18), Schaller (19), Teschendorf (20), Chiari (21), Siegert (22), Weil (23), Störk (24), M. Mackenzie (26), Störk (25) and Krishaber (27).

A study of the reported cases shows that in a little less than one-third of the number, the paillomata were confined to the trachea, and occurred mostly singly, varying in size from a pea to a pigeon egg. They are usually found in the upper part of the trachea, and in the majority of the cases are attached to the anterior wall, although they also occur on the posterior and lateral walls. Siegert (22) has reported a papilloma as large as a pigeon's egg, close to the bifurcation, and Störk (25) has also reported a case in which the growth was close to the bifurcation.

Chiari (21) diagnosed, with the laryngeal mirror, a case in which the growth was attached to the posterior wall at about the tenth ring. Maissonneuve (10), in 1856, at autopsy, found in the trachea of a boy, aged 10 years, numerous reddish-white vegetations which extended upwards to the vocal cords. They had started about two years before death, with catarrhal symptoms of the air passages.

Störk (24) observed another case in a man, aged 22 years, in which multiple papillomata were present in the trachea at the level of the third ring, with numerous laryngeal papillomata.

Labus (45-48) has reported three cases removed per vias naturales. In the first case there were papillomata of the left vocal cord, and others in the trachea (fifth to eighth rings). Removed with forceps, but recurred every three or four months. Final cure was obtained.

Second Case.—Small growth at level of third ring in boy, 13 years old. Removed with forceps. No recurrence after five years. Although a diagnosis of fibro-sarcoma was made in this case microscopically, it was probably not malignant from the fact that there was no .recurrence after an endotracheal removal.

Third Case. — Tracheal papilloma, in a man, aged 63
years, at the level of the fifth ring. Removed with forceps
in different sittings.

J. N. Mackenzie (Tr. Amer. Laryn. Ass., 1898) describes
tuberculous tumors in the trachea. which at times take the
form of papillomata.

Bruns (9) has reported two cases of tracheal papilloma
in children, aged respectively 7 and 10 years, occurring
in conjunction with multiple laryngeal papillomata. In the
case of a child of 5 years dying in a suffocative attack
('Teschendorf, 20), a mass of papillomata extending from
the epiglottis to the bronchus was found, and in another case,
a child, who had also died during an attack of suffocation,
the trachea at autopsy was found to contain numerous papil-
lomatous excrescences extending almost to the bifurcation.
Reported by Schaller (19). Sudden deaths of this kind have
occurred mainly in children, the only adult case of which I
could find any record was the one reported by M. Mackenzie
(26). Sudden death was produced in this case by a papilloma
as large as a bean.

LIPOMATA.

Only one case of genuine lipoma has been reported, by
Rokitansky (36) (Fig. 3). At the autopsy of a man, aged

Fig. 3. Rokitansky's case of lipoma of the trachea. (After
Schroetter.)

85 years, a lipoma as large as a hazel nut was found in the left bronchus.

In another case, that of Chiari (35), a primary bronchial tumor turned out to be a mixed lipoma and adenoma. The case was that of a woman, aged 68 years, who had died of emphysema. It was made up mainly of fatty tissue.

LYMPHOMATA.

I could find records of only two cases of lymphoma of the trachea. They were reported by Clark (37) and Volger (38).

In Clark's case, that of a woman aged 75 years, a tracheotomy which resulted in the death of the patient, had been performed for urgent dyspnea. The growth was found at autopsy.

In Volger's case, that of a girl aged 19 years, a round tumor as large as a cherry attached to the lateral tracheal wall, could be seen with the laryngeal mirror. It was removed by tracheo-fissure.

ADENOMATA.

Seven cases have been reported, by Radestock (29), Chiari (31), Mayer (30), Scheuer (28), Kolisko (32), Paltauf (33) and Rosenheim (34).

They are round tumors, originating as hypertrophies of the mucous glands. They are as a rule only slightly movable, and have their seat on the posterior wall of the trachea.

In Rosenheim's case, that of a young man aged 23 years, a small, red, immovable tumor was seen in the upper part of the trachea. It was removed by tracheotomy and was found attached to the cricoid and upper tracheal rings. Diagnosis: Colloid fibro-adenoma.

Scheuer reported the case of a woman, aged 56 years, in whose trachea a round tumor about the size of a cherry was found on laryngoscopic examination. It was attached to the posterior wall by a thick pedicle at the level of 6-8 rings. Removed by tracheotomy. Kolisko and Chiari have reported cases of adenoma of the bronchi. Chiari's case occurred in a man 73 years of age, who had died of tuberculosis.

FIBROMATA (FIBROUS POLYPI).

Cases of this kind have been reported by Rokitansky (51), Stallard (54), Eppinger (55), Türck (52), Maissonneuve (53),

M. Mackenzie (56), Fifield (57), M. Mackenzie (58), Crutch-ley-Mackenzie (59), Ingals (60), Avellis (64), Braun (63). Masini (62), Lewin (61), Mackenzie-Johnston (65), Oaz-mann (66), Bidwell (67), Jurasz (68), Bockenheimer (69) and Fournie (70).

Rokitansky, in 1851, reported the first pedunculated fibroma situated at the bifurcation of the trachea. He did not describe it accurately.

I will give brief abstracts of only the most interesting cases.

Türck reported the case of a fibroma found at autopsy. The patient, a man aged 37 years, had died of tuberculosis. It was situated in the upper part of the trachea, and was attached to the posterior wall. Stallard found in the trachea of a man, aged 40 years, who had died during an attack of suffocation, a polyp as large as a tonsil. It had been attached to the anterior wall of the trachea, high up.

In Eppinger's case, a man aged 23 years, who had died suddenly, a round tumor as large as a hazel nut was found on the posterior wall of the trachea, 4.5 cm. above the bifurcation. The diagnosis was made microscopically.

M. Mackenzie has reported four cases of tracheal fibroma, all the cases he observed.

In the one case, a man aged 41 years, the growth was attached to the anterior wall of the trachea at the second ring. In the second case, a woman aged 22 years, the tumor was attached to the posterior wall at the third ring. In an attempt to destroy this with the cautery both vocal cords were injured.

In the third case, a man aged 37 years, and in the fourth case, a man aged 45 years, the polypi were attached to the anterior wall, in the one at the second ring and in the other about the fourth ring.

In two of Mackenzie's cases, the polypi were destroyed with the cautery. In the fourth case, the patient refused operation, and died suddenly a few months after returning home, probably of asphyxia.

Ingals has reported a case of tracheal polyp in a man aged 60 years.

In a case reported by Lewin, in which a fibroid polyp was attached to the posterior wall of the trachea, a tracheotomy was performed, and the patient wore the canula twenty-four years. He refused any other operative procedure.

Mackenzie-Johnston and Oazmann have also reported cases of tracheal polypi. In Mackenzie-Johnston's case the growth was removed by tracheotomy, and in Oazmann's case it was removed endotracheally.

Altogether I could find records of twenty-four cases of tracheal fibroma, although there are undoubtedly more. Of this number, fifteen were pedunculated and nine were attached by a broad base. They were situated about equally in the upper and lower parts of the trachea, and attached to the anterior and posterior walls in about the same number of cases.

In the majority of the cases, they occurred in middle life, only three cases having been observed in children between the fifth and fourteenth years. In eight of the reported cases, sudden death from suffocation occurred.

ECCHONDROMATA AND CHONDRO-OSTEOMATA.

The solitary cartilaginous tumor of the trachea is almost unknown. Only one case could be found, that of Berg (*Virchow, Jahresber,* 11, p. 206, 1890). He observed a tumor as large as a nut at the fifth tracheal ring. It was removed by tracheo-fissure and was found to be made up of cartilage.

Other ecchondromata and osteomata have been reported by Solis-Cohen (41), Virchow (40), Ganghofer (39), Chiari (42), Heymann (43), Steudener (44), Hammer (45), Wilks (46), O. Chiari (47), Schrötter (48), Mischaikoff (49) and Klebs (50).

Very little is known in regard to the genesis of this interesting class of new growths.

H. Chiari (42), in 1878, described the formation of osteomata in the trachea of a man, aged 25 years, who had died of tuberculosis.

The first case of this kind was probably described by Wilks (46), in 1856. In this case, that of a woman aged 38 years, there was a formation of bone in the mucous membrane of the trachea. His patient died of pulmonary tuberculosis, and at the autopsy the whole inner surface of the trachea was covered with small movable bony plates, which were fastened to the anterior wall. No connection could be discovered with the tracheal rings.

Heymann (43) has reported a similar case in a woman, aged 61 years. In his case, a tracheotomy was performed and later a thyrotomy, resulting in the death of the patient.

Five other cases have been reported by Hammer (45).

J. Solis-Cohen (41) found in the trachea of a tuberculous patient, after death, a considerable number of minute, closely aggregated ecchondromata beneath the mucous membrane.

As will be seen from a consideration of these cases, such bony and cartilaginous formations in the trachea are practically always multiple. They have all occurred in adults between the twenty-fifth and sixtieth years.

The causes of death in cases in which this condition was found, were seven times tuberculosis, four times pneumonia and in one case each laryngeal perichondritis, meningitis, brain tumor and carcinoma of the uterus. Tuberculosis would appear to play rather an important role etiologically, although in what way has not been determined.

Mischaikoff's investigations (49) have, perhaps, helped to clear up the origin of these tracheal chondro-osteomata. He claims they do not develop from the ordinary connective tissue of the mucous membrane, but from strands of connective tissue springing from the perichondrium. This is brought about, he states, by an anomaly in the development of the tracheal cartilage.

MALIGNANT NEOPLASMS—CARCINOMATA.

Primary carcinoma of the trachea occurs most frequently as a medullary carcinoma, and exceptionally as a cylindroma (Koschier).

Langhans has shown, in a number of cases, that these neoplasms originate in the mucous glands of the trachea.

Bruns (104) has reported a case that shows a probable malignant change in an intratracheal struma. As this is the only case of which I could find any record, in which an extensive resection of the trachea was performed, I will report it rather fully.

The patient was a man, aged 31 years, who had suffered from slowly increasing dyspnea for many years. On laryngoscopic examination, the trachea was seen to be filled with rounded, nodular masses attached to the posterior wall. Bruns resected the trachea, including eleven rings, and extirpated the growth. The patient lived for six years. The histologic examination showed it to be an adenocarcinoma, probably an intratracheal malignant struma.

Tracheal cancer appears to favor the male sex; out of the cases collected by the writer, men were afflicted about twice as frequently as women.

The youngest patient was 28 years old, the average age, however, being from the fiftieth to sixtieth year. Many more cases occur between these years than between the thirtieth and fiftieth.

Tracheal cancer assumes a number of different forms.

Langhans (90), who in 1871 was the first to describe a primary cancer of the trachea, also first described the infiltrative form of tracheal carcinoma. His patient, a man aged 40 years, had suffered for years with symptoms pointing to a stenosis of the right bronchus. The true condition was not, however, determined during life. At the autopsy the lungs were found normal, the bronchial glands enlarged and melanotic. A swelling was found in the lower part of the trachea, extending upwards for about 4 cm. from the bifurcation. There were also nodules at the bifurcation, extending into the right bronchus for a distance of 2½ cm. The bronchus itself was narrowed by a number of warty-like elevations attached to its walls.

M. Mackenzie (91) has reported one case, also discovered at autopsy. In the trachea of this patient, a woman aged 57 years, an ulcerated growth occupying the middle third of the trachea was found. On microscopic examination the growth was found to be an epithelial cancer.

In Schrötter's case (92), a man, aged 58 years, a tracheotomy was performed. At autopsy a nodular mass was found in the trachea, extending from the first to the ninth rings. A microscopic diagnosis of carcinoma fibrosum was made.

Oestreich (100) observed in v. Leyden's clinic a primary carcinoma in the trachea of a woman aged 28 years, the youngest patient on record.

Another case of carcinoma at the tracheal bifurcation was reported by Ehlich (101), in a man aged 65 years.

Koschier (102) has reported two cases (cylindroma), both attached to the anterior wall, and another case (103) in a woman aged 40 years, in whose case a carcinoma was removed per vias naturales with a specially constructed sharp spoon of Störk.

Other authentic cases have been reported by Hoffman (106), Delafield (89), Gibb (93), Klebs (95), Reiche (98),

Fischer (99), Boschi (105), Körner (109), Pick (111), Hinterstoisser (112), Schmidt (113), Pogresinsky (110) and Sabourin (109).

The writer would add still another case of his own to this list. The patient, a man 58 years of age, presented himself for the relief of urgent dyspnea. With the laryngeal mirror, a mass could be seen filling the upper part of the trachea and extending to the subglottic region of the larynx. A tracheotomy was performed with cocain. No other operation could be performed, because there was already involvement of the glands of the neck. The patient lived about four weeks after the operation. A microscopic diagnosis of carcinoma was made.

In Boschi's case, a man aged 60 years, a tumor extending from the bifurcation 5 cm. upwards was found. It extended through the trachea and was attached anteriorly to the posterior wall of the ascending aorta as well as to the arch.

In all, I could find records of twenty-seven cases, making, with my own case, twenty-eight cases.

The favorite seats for primary tracheal cancer are the upper parts of the trachea, and the lower parts close to the bifurcation. The middle third is rarely involved.

In the majority of the cases the posterior wall is involved, while the anterior wall is not so frequently implicated.

The writer has considered only cases of primary tracheal carcinoma. No mention will be made of cancer secondary to laryngeal or esophageal cancer.

Carcinoma of the thyroid gland also frequently infiltrates the tracheal wall.

SARCOMATA.

Only primary sarcomata will be considered. In three cases, however, those of Jurasz (131), Pieniazek (128) and Wright (130), the larynx was also involved, but as this involvement was just about at the dividing point the origin of the tumor was probably in the trachea.

Although primary tracheal sarcoma is rarer than carcinoma, we have been able to collect eighteen cases from the literature.

They have been reported by Schrötter (115, 116), O. Chiari (118), Levi (119), Prota (120), Heyninx (121), Killian (122), Gleitsmann (123), Schrötter (124), Labus (125),

Johnston-Cottrill (126), Bamberger-Billroth (127), Schech (129), Pieniazek (128), Wright (130), Jurasz (131) and Mayer-Hüni (132).

In seven cases endotracheal operations were performed.

Of these, one of Schrötter's cases (116), lived twenty years, with many recurrences. Gleitsmann's case, which I will describe more fully later on, lived nearly two years, with a recurrence in about fifteen months.

In Heyninx's case (121), in which a myxosarcoma was removed from the trachea of a woman, aged 41 years, with the hot loop, I could find no record of the final result.

In three cases no recurrence could be detected after a short period, cases of Labus (125), Johnston-Cottrill (126) and Schech (129).

Of the cases operated on by tracheo-fissure, the final result is known only in a few. In Mayer-Hüni's (132) and Wright's (130) cases, no recurrence took place for a considerable period. In Jurasz's case (131) a slowly growing recurrence was noticed after two years.

Prota (120) has reported two cases, both in women between 40 and 50, in whom the growth was situated high up in the trachea.

Gleitsmann (123) has reported one of the few cases of tracheal sarcoma operated upon endotracheally.

The tumor in his case, that of a man aged 52 years, was situated in the upper part of the trachea and nearly filled its lumen. It was as large as a small walnut. The tumor was removed endotracheally with the Schech canula, iridoplatinum wire, devised by Gleitsmann in 1894, being used. The growth was brought through the glottis without difficulty.

There was no recurrence for about fifteen months. The further history of the case which Dr. Gleitsmann kindly sent me is as follows: In March, 1903 (the first operation was performed in December, 1901), a small tumor reappeared below the anterior commissure and was removed with the snare as before. During the following month (April, 1903) the ventricular band became infiltrated, pain, fever and aphonia developed, and at the last examination, May 9, 1903, the left half of the larynx did not move freely, and in the trachea small nodules could be seen below the anterior commissure and below the left vocal cord. A radical operation which was

recommended was declined, and the patient was not seen again by Dr. Gleitsmann. He died some time in 1903.

This case teaches a valuable lesson. It proves the fact that endotracheal operations for malignant neoplasms offer very little chance of success. I have not been able to find records of any cases in which a case remained permanently cured after an endotracheal operation. In the three cases before mentioned, those of Labus, Schech and Johnston-Cottrill, the statement was made that a cure was obtained after a "short period."

Both sexes seem to be equally afflicted with tracheal sarcoma and young rather more frequently than persons more advanced in years.

As a rule, tracheal sarcomata are attached to the tracheal wall by a broad base, and have a smooth surface. Occasionally they are pedunculated. They often reach a considerable size and almost completely fill the tracheal lumen.

For the sake of completeness, I will give brief abstracts of two other tracheal tumors, reported by Johanni (134) and Henrici (135).

The tumor in Johanni's case filled the lower part of the larynx and upper part of the trachea, in a woman aged 66 years, and finally caused her death. An exact histologic examination is given. It was called an amyloid tumor.

In Henrici's case a tumor was present in the trachea of a man aged 61 years, who had suffered from "asthma" for fifteen or twenty years. It was situated on the posterior wall at the level of the third ring. A tracheo-fissure was made, and the tumor, which was 2.5 cm. long and covered with a smooth intact mucous membrane, was removed. Patient died suddenly two months after operation.

The classification of the tumor could not be determined by the microscopic examination.

A review of the recorded cases of intratracheal tumors brings out some interesting points.

Of the benign growths, papillomata occur most frequently, and of the malignant, carcinomata are most frequently observed.

The following table shows the order of frequency, with the number of each variety of tumor collected by the writer. This number could undoubtedly be added to materially, but it comprises most of the authentic cases on record to date.

Benign: Papillomata, 25 cases; fibromata (fibrous polypi),

24 cases; ecchondromata and chondro-osteomata, 17 cases intratracheal strumas, 10 cases; adenomata, 7 cases; lipomata, 3 cases; lymphomata, 2 cases; amyloid tumor, 1 case.

Malignant: Carcinomata 28 cases, sarcomata 18 cases, making in all 135 cases, 89 of which are benign and 46 malignant.

A study of the cases shows also that tracheal tumors are situated, in the majority of the cases, in the upper part of the trachea, and less frequently in the lower part. They most rarely occur in the middle of the trachea. They are attached most frequently to the posterior wall, which is rich in mucous glands. This is particularly true of the carcinomata, which appear to take their origin from these mucous glands.

Some other interesting facts are brought out by a consideration of the reported cases of tracheal tumors.

In the first place, their great rarity. The 135 cases collected by the writer represent nearly all the authentic cases recorded during the past seventy-five years. The majority of the cases have been reported, of course, since the first one observed with the laryngoscope in 1861.

The rarity of tracheal tumors becomes much more striking when the 89 benign and 46 malignant tracheal tumors are compared to the 10,747 benign and 1,550 malignant laryngeal tumors, which Semon collected between 1862 and 1888.

The malignant tumors of the larynx represent only about 12½ per cent of the total number, while in the trachea, according to the cases collected by the writer, they represent about 34 per cent of the total number. These figures are significant, because they show that a strong suspicion of malignancy must always attach to a tracheal tumor.

ETIOLOGY.

Very little is known in regard to the etiology of most tracheal tumors, and writers as a rule barely mention it. In considering the etiology of tracheal new growths, etiologic factors such as congenital displacement of tissue, predisposition and a general specific diathesis of the system are of importance.

The fact that the trachea is not more often the seat of new growths may be explained by its protected position and its somewhat passive function. It is not easily subjected to mechanical or chemical irritation.

Granulation tumors originating after tracheotomies were not

considered in the writer's paper, because they are not true new growths. A chronic inflammation of the tracheal mucous membrane probably plays an important role in the development of neoplasms. An inflammatory process, in conjunction with pulmonary tuberculosis, seems to have an important etiologic bearing on the development of cartilaginous and bony formations. There is no apparent reason for this, however.

The etiology of intratracheal struma, which has been well worked out, has already been considered in this paper.

SYMPTOMS.

As the main symptoms of all tracheal growths are those produced by the resulting stenosis, and as we are to have an exhaustive paper on this subject, I will not mention symptoms directly caused by stenosis at all.

There are a few symptoms, however, which can be attributed to the tumors themselves. Tumors in the trachea may be present for years without causing any special symptoms, and it is surprising that even large ones sometimes cause so little disturbance.

A case has been reported by Siegert (22), in which a papilloma as large as a pigeon egg was situated at the tracheal bifurcation, and did not cause any particular difficulty in breathing. This patient, a man 54 years old, died of general septicema following an infection of a wound, and the tumor in the trachea was found at autopsy.

In one of Schrötter's cases (115), the patient lived many years with a sarcoma that almost completely filled the tracheal lumen.

In some cases attacks of suffocation come on only periodically. This was so in a case reported by Fifield (57), in which a fibroid polyp as large as a berry, covering the opening of the left bronchus, was found at autopsy.

The character of the dyspnea varies according to whether the growth is pedunculated and freely movable or not. A movable growth acts like a valve, so that at times there will be an inspiratory dyspnea and at other times an expiratory dyspnea.

Gerhardt claims that a bending forward of the head is a symptom that is always present in tracheal obstruction, while in laryngeal stenosis the head is bent backwards.

The voice, as a rule, is not affected, except when growths

with long pedicles are situated high up in the trachea, and are carried to the glottis by the air currnet. In such cases some hoarseness may be present without much dyspnea. Masini (62) and Jurasz (68) both observed cases of this kind.

The voice may be also affected by an involvement of the recurrent laryngeal in cases of tracheal carcinoma. Such observations have been made by Hinterstoisser (112) and Oestreich (107).

Secondary symptoms are also produced, particularly by slowly growing tumors. Occasionally, diffuse bronchiectasis, empyema and atelectasis are produced in certain portions of the lungs. Catarrhal bronchitis and lobular pneumonia are also sometimes complications.

Körner (109) has reported a case in which carcinoma in the lower part of the trachea encroached upon the right bronchus, and produced an obstructive atelectasis of the whole right lung.

DIAGNOSIS.

When the characteristic symptoms are present it is usually quite easy to make a diagnosis of some tracheal obstruction, although without direct inspection it would be hard to determine whether the obstruction is caused by a tumor, a stricture or a foreign body. The diagnosis of a tracheal stenosis, the most common symptom of intratracheal growths, is of course simple. It must be determined, however, whether the cause is in the trachea itself or from external pressure.

An examination of the upper part of the trachea, except in young children, can usually be made with the ordinary laryngeal mirror, after cocainization, in some cases without it.

Laryngoscopy can, however, be quite easily practiced even in young children if they are given a little chloroform or somnoform. A forehead lamp or a self-illuminating mirror is most convenient.

For laryngoscopy under an anesthetic, a loop of silk worm gut may be passed through the tongue, as recommended by Jackson (*Laryngoscope,* April, 1905). it will not cause as much soreness as a tongue forceps. The Kirstein spatula is also of service for diagnosticating tumors in the upper part of the trachea, and in children can be used just as well under general anesthesia. A good inspection of the trachea in adults may often be obtained, if the patient is examined while stand-

ing, according to Killian's method. In six of the seven cases of tracheal tumors operated upon by Bruns, he was able to make the diagnosis with the ordinary mirror. After cocainization, much can be learned in regard to the nature of the growth with an extra long laryngeal probe. Instead of employing Kirstein's autoscopy, a Grant epiglottic lifter may be applied, with the patient in Rosen's position, and the upper part of the trachea inspected in this way.

An X-ray examination will at times show the presence of tumors that cannot be easily inspected and is a great aid in the diagnosis. For tumors below the middle of the trachea, Killian's tracheoscopy or bronchoscopy would be of service if the tumor cannot be inspected in any other way.

As the methods of performing tracheoscopy, as well as the improvements of Ingals, Jackson and others in instruments and methods of lighting the deeper parts of the trachea and bronchi are so well known, I will not mention them here.

As an operation would have to be performed in any event, it is best to perform tracheotomy when symptoms become urgent and make the diagnosis and perform the operation for the removal of the growth at the same time, rather than to subject the patient to a preliminary bronchoscopy or tracheoscopy. After tracheotomy an excellent inspection of the lower part of the trachea may be obtained through the ordinary Kelly cystoscope, after passing it through the tracheal wound. An ordinary head mirror can be used in throwing light through the cystoscope. Small benign tumors may be removed through the cystoscope with forceps, particularly if a large cystoscope is used.

The fibroma or fibrous polyp is usually pedunculated, and Schrötter (114) has reported a case of a distinctly pedunculated sarcoma which was freely movable.

In Pröbsting's case (132) an apparent polyp with a long pedicle which had been coughed out was found to be carcinomatous. The intratracheal struma has been fully considered.

It is often difficult to make a differential diagnosis between carcinoma and sarcoma.

It was found in a study of the cases that carcinoma occurs more frequently, particularly in men of advanced years. When metastases, which are rare in primary tracheal carcinoma,

occur in the lymphatic glands of the neck or in the larynx, esophagus or bronchi there is no doubt about the diagnosis.

Sarcoma usually occurs as a growth with a broad base and smooth surface. It grows slowly, sometimes becoming very extensive, however, and shows little tendency to ulceration.

Carcinoma shows a greater tendency to ulceration and is usually more irregular in outline.

The tracheal papilloma can as a rule be recognized by its appearance, particularly when it occurs in children; it is also present at the same time in the larynx.

Schrötter (113) has described a tracheal carcinoma occurring in the form of papillomatous excrescences. Wright (129) has also described sarcoma simulating papilloma.

PROGNOSIS.

The prognosis of tracheal neoplasms, unless some operative measures are promptly carried out, may be said to be almost absolutely unfavorable, because without operation, the stenosis caused by the tumor becomes greater all the time, and the patient may suddenly die of asphyxia even before a tracheotomy can be performed. The higher up in the trachea the tumor is situated the more favorable the prognosis, because it can not only be more easily reached during operations, but if tracheotomy becomes necessary, the canula can be introduced below the tumor.

When tumors are present low down in the trachea near the bifurcation a tracheotomy, without at the same time a removal of the growth, may not do much good, because it would be difficult to get the end of the canula below the growth. The fibromata, particularly the pedunculated polypi, according to all authorities, give the most favorable prognosis, because they usually occur singly, and do not show a tendency to recur when removed.

Lemoine (7) states that in twenty-six cases of benign tracheal growths collected by him, cures were obtained by operations in ten out of fourteen patients; of twelve not operated upon, ten died.

The prognosis of the intratracheal strumas is also favorable, as their growth is very slow and they apparently do not readily recur after removal. In the writer's case before mentioned, removed by tracheo-fissure, there has been no recurrence since the operation was performed in 1901.

The papillomata are not so favorable, because they are usually multiple, often recurring simultaneously in the larynx and trachea, and show a decided tendency to recur after removal.

Among the cases collected, the endotracheal removal was performed in eight, in all of which the growths were situated in the upper part of the trachea. There were recurrences in a number of these cases.

In four cases, all children, laryngo-tracheo-fissure was performed in order to remove at the same time the laryngeal and tracheal growths. A number of these cases subsequently died of recurrences. The carcinomata offer the most unfavorable prognosis of all. Statistics show that patients afflicted with tracheal carcinoma live as a rule only a few months, although they may live several years. Death usually results through slow suffocation, pneumonia or metastases to neighboring organs.

On the other hand, observations are on record to show that at times the disease remains localized for a very long period. Tracheotomy does not seem to prolong life much in these cases, but if the canula can be applied below the growth, it certainly makes the patient's death easier. Schrötter (114) has reported a case in which it was not possible to get in the canula.

From the fact that some cases of tracheal carcinoma develop so slowly, and show no tendency to metastasis, it does not seem too much to hope for, that in the near future a radical operation such as a resection of the trachea will be performed more frequently and just as brilliant results obtained as in early laryngectomy for laryngeal cancer. I have been able to find only one case in the literature in which a resection of the trachea for carcinoma was performed. This case was reported by Bruns (103). His patient lived six years after the operation. Koschier (101) has reported a case in which a carcinoma (cylindroma) was removed by tracheotomy, and six months later no trace of a recurrence could be dectected. In tracheal sarcoma the prognosis does not appear to be extremely unfavorable. Data are lacking in regard to recurrences of tracheal sarcoma after removal. In fact, practically nothing is known about it. In Gleitsmann's case of the endotracheal removal of a sarcoma, there was no recurrence for about fifteen months, but soon after that the tumor did recur.

The growth of sarcoma in the trachea is very slow, the dis-

ease often extending over a period of years. Nor does the growth show any tendency to ulceration or extension to the surrounding structures.

Of the seven endotracheal operations on record, for tracheal sarcoma, three cases were reported cured, although there is no record to show that they remained cured. These three cases were called cured because there was no recurrence in four or five months. In one case there was a recurrence, but the patient lived many years, and one case rapidly terminated fatally. Another patient (Gleitsmann's) lived nearly two years after the operation.

The growths in five cases were removed by tracheotomy, and in two there had been no recurrence after three months and one year. In one case there was a recurrence after two years. In two cases tracheotomy was followed by a fatal issue.

TREATMENT.

The treatment of the large majority of the cases of tracheal tumors may be summed up in the one word, operative. Palliative measures may be used when growths are so small that they do not interfere to any extent with breathing, but it must be remembered that a good many of the tracheal growths have a fairly rapid growth, so that it is safer to remove even small growths as soon as the diagnosis is made.

Tracheotomy performed for the purpose of relieving breathing comes under the head of palliative measures, and is successful if the canula can be inserted below the growth.

As statistics show that in over one-half of all cases, tracheal neoplasms are situated in the upper third of the trachea, a low tracheotomy would relieve the patient's breathing in a majority of the cases. In cases in which the tumor is situated very low down in the trachea, a piece of a rubber stomach tube may be used in case of emergency, if a long tracheal canula will not reach below the growth. In such cases, if the patient's condition permits it, it would be wise to attempt the removal of the growth as soon as free respiration is established. Other conditions sometimes make tracheotomy difficult and even impossible.

The patient died in one of Schrötter's cases (114) while he was attempting to perform tracheotomy. The lumen of the trachea was so filled with the growth (carcinoma) that the canula could not be inserted.

In inoperable cases, a tracheotomy will have to be performed in any event, and in operable cases it not only prepares the way for a thorough inspection of the trachea, either with the finger or through a tube, but it is at times a necessary preliminary step to an endotracheal operation.

Endotracheal Operations.—Operations through the mouth should be performed only for small pedunculated benign growths, situated high up in the trachea. Endotracheal operations for malignant growths do not offer a much better chance of success than endolaryngeal operations for laryngeal cancer. They should not be attempted. Statistics in regard to the recurrence of tracheal sarcoma after endotracheal removal are sadly deficient.

The results of the seven endotracheal operations for sarcoma, as well as those removed by tracheo-fissure, have already been given. The most favorable tumors for removal through the mouth are the papillomata, and about a dozen such operations have been performed—a majority of all endotracheal operations.

The technic is the same, except that longer instruments have to be used, as for the laryngeal operations.

Children can be operated upon under general anesthesia, with the aid of the Kirstein spatula.

The removal of a tracheal tumor by tracheotomy, or better tracheo-fissure, is the operation of choice for the majority of the cases. Benign neoplasms of all kinds can be readily and radically removed in this way, and there is much less chance for recurrence than when they are incompletely removed through the mouth. This is particularly true of the five cases of intratracheal struma (4 of Bruns' and the writer's case), in which there have been no recurrences after radical operations (tracheo-fissure). There are about twenty such operations for different tracheal growths on record.

Mayer-Hüni (132) removed in this way a sarcoma situated just above the bifurcation.

In performing these operations, the anterior wall of the trachea should be split for a considerable distance, so as to give the operator plenty of room. Either a tampon-canula can be used or the operation can be performed in some cases of benign growth without it, with the patient in the Trendelenburg position.

Resection of the trachea has only been performed in one case, that of Bruns' (104), before alluded to.

He removed a carcinoma of the posterior tracheal wall, including the posterior wall and ten of the rings, keeping the patient alive for six years.

After tracheotomy, small tumors low down in the trachea may at times be removed through a cystoscope under direct inspection.

BIBLIOGRAPHY.

GENERAL.

1. Koch, W. Geschwülste d. Luftröhre. Archiv. f. klin. Chirurgie, Bd. XX, S. 540, 1876.

2. Roch, P. S. L. tumeurs de la trachée. Ann. d. mal. l'oreille, &c. XVI, p. 682, 1890.

3. Müller, H. Ueber Luftröhrengeschulste. Diss. Jena, 1865.

4. Orth, D. Die Neubildungen der Trachea. Diss. Heidelberg, March, 1892.

5. Schrötter. Vorlesungen u. d. Krankheiten d. Luftröhre., 1896.

6. Scheuer. Ueber Trachealtumoren, Diss. München, 1893.

7. Lemoine. Etude sur les tumeurs de la trachée. These de Paris, 1899.

8. Bruns, P. v. Die Neubildungen in der Luftröhre. Heymanns' Handbuch der Laryngologie und Rhinologie L. 23, 1898.

BENIGN NEOPLASMS.
Papillomata.

9. Bruns. Die Laryngoskopie, S. 322, 1865.

10. Maissonneuve. Bull. de la soc. Anatomique de Paris, XXXI, p. 143, 1856.

11. Davis-Colley. British Medical Journal, Vol. II, p. 354, 1872.

12. Schrötter. Wiener med. Blätter. No. 43, 1880.

13. Mackenzie, M. British Med. Journal, May 30, 1874.

14. Mackenzie, M. Diseases of the Nose and Throat. Vol. 1.

15. Labus. Archiv. Ital. di laringologia, No. 1, 1881.

16. Butlin. St. Barthol. Hosp. Rep. 1882, p. 129.

17. Labus. Monatschr. f. Ohrenheilkunde, p. 124, 1886.

18. Solis-Cohen, J. Ashhurst's Internat. Encyclopedia of Surgery, Vol. V, p. 340, 1888.

19. Schaller. Seltener Fall v. Kehlkopf. u. Trachealpapillom, Dissert. München, 1889.

20. Teschendorf. Fall von multipl. Papill. d. Larynx u. Trachea. Dissert. Königsberg, 1893.

21. Chiari. Erfahrungen auf d. Gebiete d. Hals u. Nasenkrankh. S. 35, 1887.

22. Siegert. Virchow's Arch. Bd. CXXIX, S. 413, 1892.

23. Weil. Monatschr. f. Ohrenheilkunde. No. 12, 1892.

24. Störk. Klinik d. Krankheiten d. Kehlkopfes. S. 438.

25. Störk. Ibid.

26. Mackenzie, M. Essay on Growths in the Larynx. London, 1871, p. 111.

27. Krishaber. Gaz. des Hopit., No. 84, 1874.

Adenomata.

28. Scheuer. Diss. München, 1893.

29. Radestock. Beiträge z. path. anat. (Ziegler). Bd. III, S. 289, 1888.

30. Mayer, E. Ueber d. maligne adenom d. Schilddrüse. Fränkel's Archiv. Bd. V. S. 389, 1896.

31. Chiari, O. Prag. med. Wochenschr. No. 51, 1883.

32. Kolisko. See Schrötter, Vorles u. d. Krankh. d. Luftröhre. S. 149.

33. Paltauf. Beitr. zu path. anat. Bd. XI.

34. Rosenheim. Tracheal Tumor. Amer. Jour. Med. Sciences, June, 1904, and N. Y. Med. News, April 2, 1904.

Lipomata.

35. Chiari, O. Prag. med. Wochenschr. No. 51, 1883.

36. Rokitansky. Zeitschr. d. k. Gesellschaft d. Aerzte z. Wien 1851, S. 177.

Lymphomata.

37. Clark. Med. Times and Gaette, Dec. 13, 1873, p. 679.

38. Vogler. Ueb. d. primär. tracheal tumoren. Diss. Zurich, 1896.

Ecchondromata and Chondro-Osteomata.

39. Ganghofer. Zeitschr. f. Heilkunde. Bd. 1, S. 350, 1880.

40 Virchow. Die Geschwülste. S. 442, 1863.

41. Solis-Cohen, J. Ashhurst's Internat. Encylopedia of Surgery, Vol. V, p. 340.

42. Chiari, O. Wiener med. Zeitschr. No. 34, 1878.

43. Heymann, R. Virchow's Archiv. Bd. 116, S. 329.

44. Steudener. Ibid, Bd. XLII.

45. Hammer. Zeitschr. f. Heilkunde, Bd. X, S. 458, 1889.

46. Wilks. Trans. of the Path. Soc., London, Vol. VIII, p. 88, 1857.

47. Chiari, O. Wiener med. Zeitschr. 1882.

48. Schrötter. Vorlesungen u. d. Krankh. d. Trachea, S. 41.

49. Mischaikoff. Ueber Knochenbildungen in der Trachealschleimh. d. Menschen. Diss. Zurich, 1894.

50. Klebs. Handbuch d. path. anat. Bd. II, S. 299.

Fibromata (Polypi Fibrous Polypi).

51. Rokitansky. Wiener med. Zeitschr. VII, 1851.

52. Türck. Krannheiten d. Kehlkopfes. S. 502, 1886.

53. Maissonneuve. Reported in Gerhardt's Handbuch f. Kinderkrankh. III, S. 269.

54. Stallard. (Klebs' Handbuch d. path. anat. Bd. II, S. 296).

55. Eppinger. Ibid.

56. Mackenzie, M. Diseases Nose and Throat, Vol. I, p. 504, 1880.

57. Fifield. Boston Medical and Surgical Journal, November 14, 1861.

58. Mackenzie, M. (Reported in Monatschr. f. Ohrenheilk. S. 26, 1885.

59. Crutchley-Mackenzie. Lancet, November 8, 1884.

60. Ingals, E. F. Annales de malad. de l'oreille, &c., 1884, p. 365.

61. Lewin. Berliner klin. Wochenschr. S. 64, 1886.

62. Masini. Rev. mens. de laryng. 1887, No. 3

63. Braun. Weiner med. Blätter, No. 30, S. 468, 1889.

64. Avellis. Monatschr. f. Ohrenheilk. No. 7, 1892.

65. Mackenzie-Johnston. Edinb. Med. Journal, V. XXX, June, 1886.

66. Oazmann. Reported in Monatschr. f. Ohrenheik, S. 226, 1888.

67. Bidwell. British Med. Journal, November 8, 1890.

68. Jurasz. Versamml. süddeutsche Laryng., 1896.

69. Bockenheimer. See M. Schmidt. Krankheiten d. oberen Luftwege. S. 602, 1897.

70. Fournie. Gaz. des Hop., No. 56, 1868.

Intrathacheal Struma.

71. Neumayer, H. Intratracheale Strumen. Monatschr. f. Ohrenheilkunde No. 9, 1894. (Diagnosis not proved.)

72. Frankenberger. Struma intratrachealis, Monatschr. f. Ohrenheilk., No. 12, 1904. (Diagnosis not proved.)

73. Ziemssen. Handbuch der speciellen Pathologie und Therapie, Bd. IV, 1875.

74. Bruns, P. Die Laryngotomie z. entfernung endolaryngealen Neubildungen, S. 201, und Heise, Beiträge z. klin. Chirurgie, Bd. III, S. 109-132, 1888.

75. Heise. Ueber Schilddrüsentumoren im inneren d. Kehlkopfes u. d. Luftröhre. Beiträge z. klin. Chir. Bd. III, S. 109, 1888.

76. Heise. Ibid.

77. Roth. See P. Bruns. Zur Frage der Entkropfungskachexie. Beiträge z. klin. Chir. Bd. III, S. 329, 1888.

78. Paltauf, R. Schilddrüsentumoren im inneren d. Kehlkopfes u. d. Luftröhre. Beiträge zur path. Anat. u. z. allgem. Path. Bd. XI, S. 71-90.

79 Bruns, P. Handbuch d. Laryngol. u. Rhinologie (Heymann), S. 966, 1898.

80. Baurowics. Ueber Schilddrüsengeschwülste im inneren d. Kehlkopfes, etc. Archiv. f. Laryngol. u. Rhinol. Bd. VIII, S. 362, 1898.

81. Freer, O. T. Thyroid Tissue in the Larynx and Trachea. Journal of the American Medical Association, p. 876, March 30, 1901.

82. Theisen, C. F. A case of Intratracheal Colloid Struma. Operation. Recovery. American Journal of the Medical Sciences, June, 1902.

83. Gruber, W. Ueber die glandula thyroidea accessoria. Archiv. f. path. Anat. Bd. LXVI, S. 447, 1876.

84. Gley. Glandes et. Glandules thyroides du chien. Societe de Biologie, February 25, 1893.

85. Kolisko. See Schrötter. Vorlesungen u. d. Krankheiten d. Luftröhre, S. 149, 1896.

86. Orth. Bd. I, S. 586.

87. Streckeisen. Beiträge z. Morphologie d. Schilddrüse. Virchow's Archiv. Bd. CIII.

88. Radestock, V. Beiträge z. path. Anat. (Ziegler) Vol. III, S. 289, 1888.

MALIGNANT NEOPLASMS.

Carcinomata.

89. Delafield. New York Medical Journal, p. 406, 1882.

90. Langhans. Virchow's Archiv. Bd. 53, S. 540, 1871.

91. Mackenzie, M. Diseases of the Nose and Throat. Vol. I, p. 508, 1880.

92. Schrötter. Laryngologische Mittheilungen. 1875, S. 86.

93. Gibb. Quoted by Orth.

94. Gerhardt. Deutsche med. Wochenschr. S. 1,024, 1887.

95. Klebs. Virchow's Archiv. Bd. 38, S. 212, 1867.

96. Schrötter. Laryngol. Mitthell. S. 86, 1870.

97. Schrötter. Jahresber. d. Klin. f. Laryngoskopie, 1873, S. 103.

98. Reiche. Deutsche Med. Wochenschr. S. 219, 1892.

99. Fisher. Monatschr. f. Ohrenheilk. No. 12, 1882.

100. Oestreich, D. Primäres carcinom d. Trachea. Deutsche med. Wochenschr. No. 9, 1895.

101. Ehlich. Monatschr. f. Ohrenheilk. No. 3, 1896.

102. Koschier, H. Wiener klin. Wochenschr. No. 24, 1896.

103. Koschier, H. Ein Beitrag z. Kenntniss d. Trachealtumoren. Wiener med. Wochenschr. No. 35, 1898.

104. Bruns, P. Resection der Trachea bei primären Trachealkrebs. Beitr. z. klin. Chirurgie. XXI, 1898, S. 284.

105. Boschi, E. Scieta Medico-chirurgica di Bologna. December 22, 1899.

106. Hoffman, R. Ein Fall von isolirten primären Carcinom d. Trachea. Monatschr. f. Ohrenheilkunde, No. 8, 1905.

107. Oestreich, D. Zeitschr. f. klin. Med. Bd. 28.

108. Sabourin. Annal. d. mal de l'orielle, &c., p. 11, 1879.

109. Körner. Münch. med. Wochenschr. No. 11, 1888.

110. Pogrebinsky. Rev. mens. de laryngol. No. 12, 1894.

111. Pick. Wien. klin. Wochenschr. No. 4, 1891.

112. Hinterstoisser. Ibid., No. 19, 1889.

113. Schmidt, Moritz. Op. cit. S. 641.

114 Schrötter. Vorlesungen u. d. Krankh. d. Luftröhre, S. 178.

Sarcomata.

115. Schrötter. Jahresber. d. Klinik. f. Laryngoskopie, S. 80, 1871.

116. Schrötter. Laryngol. Mittheilungen, S. 102, 1875.

117. Bergeat, H. Das Sarcom d. Kehlkopfes u. d. Luftröhre.. Monatschr. f. Ohrenheilk. No. 8, 9, 10, 11, 1895.

118. Chiari, O. Wiener klin. Wochenschr. No. 52, 1896.

119. Levi, C. Tumeur sarcomateuse de la trachée. Societé anatomique de Paris, April, 1897.

120. Prota, G. Sarcom primario della trachea. Arch. Ital. di Laringologia. April, 1899.

121. Heyninx.   Ber. d. bel. oto., rhin., laryngol. Gesellsch. June 17 and 18, 1905.

122. Killian, Gustav.   Ein Trachealsarcom.   Archiv. f. Laryngol. u. Rhinol. Bd. XII, III, S. 423, 1902.

123. Gleitsmann, J. W.   Subglottic sarcoma removed endolaryngeally, etc.   Trans. Amer. Laryngol. Ass., 1902.

124. Schrötter.   Wierer med. Jahrb., 1868.

125. Labus.   Gaz. d. hospit. No. 22, 1880.

126. Johnston-Cottrill.   Edinburgh Med. Journal, June, 1886.

127. Bamberger-Billroth.   Centralbl. f. Laryngologie.   Bd. IV, S. 456.

128. Pieniazek.   Arch. f. Laryngol. Bd. IV, S. 226.

129. Schech.   Krankheiten d. Kehlkopfes u. d. Luftröhre, 1897.

130. Wright.   Journal of the Amer. Med. Ass., September 26, 1891.

131. Jurasz.   Krankheiten der oberen Luftwege., 1892.

132. Meyer-Hünl.   Correspondenzbl. f. schweitzer Aeräte, 1881.

133. Pröbsting.   Versamml. süddeutscher Laryngol. 1896, (carcinoma).

Amyloid Tumor.

134. Johanni, J. W.   Fränkel's Archiv. f. Laryngol. etc. Bd. 14, H. 2, S. 331.

Unclassifid.

135. Henrici.   Ein Beitrag zur Kenntniss der Trachealtumoren. Archiv. f. Laryngol. u. Rhinol. Bd. XVII, H. II, S. 283, 1905.

STENOSES OF THE TRACHEA.*

By William Kelly Simpson, M. D.,

PROFESSOR OF LARYNGOLOGY IN COLUMBIA UNIVERSITY.

NEW YORK.

In speaking on that portion of the subject allotted me, namely, Stenoses of the Trachea, and to keep well within sequence with the other papers forming this discussion, one is confronted with two very important considerations: First, whether the morbid processes causing the stenoses originate within and confine themselves to the trachea itself—that is, are not an extension of the larynx above or the bronchi below; and, secondly, whether the stenosis is due to conditions arising within the trachea or to compression of the trachea from without.

Stenosis arising within the larynx and continuing to the subglottic portion and the trachea below was well and thoroughly considered in detail at the 1905 meeting of this Association by Dr. John Rodgers, and need not be considered here. (1) So my remarks will pertain more especially to stenoses confined to the trachea itself, realizing, however, the difficulty of such an absolute limitation.

Causes.—For the purpose of a more thorough discussion, causes of tracheal stenosis may be divided into extrinsic and intrinsic, the extrinsic variety including that form known as compression of the trachea; and it sometimes follows in this relation that causes which originate without, may, by extension of the lesion, incorporate the tracheal lumen and thus develop an additional or true tracheal stenosis. This is probably seen to happen more in malignant disease than in other forms of external causes, and, further, various external causes, such as aneurisms, abscesses and suppurating glands, may—after a period of pressure—rupture and discharge their contents into the trachea, çausing often an acute fatal termination. Among the extrinsic causes may be mentioned:

      1. Struma, which, according to Chiari, is the most common of external causes (2).

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2. Pressure by various tumors, whether benign or malignant.

3. Glandular hypertrophies, including tubercular, and the various phases of goitre. Thymus hypertrophy in the opinion of Riegel and others (3), though it may (though rarely) cause compression stenosis, shows the effects of compression mainly on the vascular and nervous trunks.

4. Pressure by emphysema, either traumatic or extending from pulmonary disease below.

5. Aneurisms, either from the aorta below or from the lateral cervical vessels.

6. Diffuse or localized phlegmonous cellular inflammations of the neck, with or without the production of abscess.

7. Extension of bone disease from sternum, clavicle and vertebral column (4).

8. Traumatisms, including fractures, ruptures, cut-throat, strangulations, etc.

Mediastinal diseases, though giving rise to pressure on the primitive bronchi, are not regarded by Riegel (5) as frequent causes of tracheal pressure; if so, the compression is not very great.

Chiari (6) mentions an occasional cause called struma ventosa; i. e., accumulation of air in the region of the upper portion of the thorax, after injuries of the large air passages.

The character, intensity and difficulty of determining the various external causes depend on the location of the compression factor—those from deep within the tissues of the neck, those posteriorly situated and those arising from below being the most difficult in point of determination and relief; while those more external in their nature and laterally situated offer the most easy solution from all points of view.

Frequently, from long continued lateral pressure, the trachea may be deflected from its median position in part or in the whole of its entire length, which fact must be borne in mind, as it often adds greatly to the difficulty in operative procedure for relief.

Intrinsic causes may be conveniently classed as being due to:

1. Cicatrices and adhesions.

2. Morbid growths and foreign bodies.

3. Inhalation of smoke, flame, volatile fumes; ingestion of corrosive chemicals and acids.

4. Inflammations, thickening of tracheal walls.

According to Chiari (7) intratracheal stenosis is much more rare than that from external causes, but when it does exist it involves a greater extent of tracheal lumen. The form and severity depends essentially on the causative factor, no two cases seeming to be alike in detail of stricture formation, which makes it a most interesting study in reviewing the many reports of isolated cases and which bears greatly on the individual ingenuity in the way of treatment.

Under the first heading, tertiary syphilis and secondary stricture from tracheotomy are undoubtedly the most common causes, the cicatrization and contraction of the syphilitic ulcer following the same law in destructive deformity as seen so commonly in the larynx and pharynx above. Though generally irregular in shape, certain cases show a distinct annular formation with a comparatively uniform stenotic aperture.

Although ulcerations from glanders, diphtheria, typhoid fever, tuberculosis and even so-called catarrhal ulcerations, have been reported as producing tracheal strictures, the instances are but exceptional. In this relation I may mention the extensive and interesting account by Schrötter (8), with detail of treatment and illustrations, of a case of primary tracheal tuberculosis producing stricture. He goes deeply into the subject and offers many conclusions worth reading.

The irritation from a long-continued wearing of a tracheal canula, from whatever cause it may have been originally introduced, frequently produces a secondary stricture along the various parts of contact, and this liability must always be given thought when tracheotomy is performed, and every effort made to dispense with the canula as soon as possible, especially if originally introduced as a temporary procedure; and a choice of size and shape of canula should be made which will have the least tendency to these after-pressure effects. Though occurring at either extremity of the canula, the most frequent location of secondary stricture is at the upper end, about and above the orifice of the tracheal opening, where granulations may form which subsequently may become very dense and on attempt at removal of canula may fall down in the trachea, thus necessitating the constant re-introduction

of the tracheal tube to prevent suffocation. The granulations may take on the character of the original cause for which the tracheotomy was performed, especially if for malignancy or papilloma; or there may be formed hard, firm, contracting granulation tissue, due to pressure effect and independent of any diseased condition. This contraction becomes very marked in some instances, completely shutting off any connection with the larynx above. This condition offers one of the most difficult factors in attempts at restoration of the tracheal lumen by dilatation.

Tracheotomy may also produce an inverting of the tracheal rings, and also tracheal defects from pressure absorption with subsequent strictures at these points. The tendency of these after-effects depends greatly on the diseased conditions of the mucous membrane producing the original cause of the stenosis.

Strictures from intratracheal growths and foreign bodies will be duly considered under the portion of the discussion allotted to those subjects, and need no mention here.

Strictures resulting from inhalation of smoke or flame, scalds, volatile fumes, the ingestion of corrosive chemicals and acids sometimes occur, and in some instances the resultant damage may be more or less limited to the trachea, but as a rule there is a general involvement of the contiguous passages. These accidents are naturally of a severe type and are apt to prove fatal in the initial inflammation.

Strictures from primary or inflammatory thickening, or hypertrophy of the tracheal walls, may arise from other ulcerations, edema, acute or chronic inflammatory swellings, perichondritis, abscesses or scleroma.

Symptoms.—Although cough, change in character of voice, sense of irritation or uncomfortable suffocative sensations about the throat may lead to suspicion of tracheal implication, the chief symptom is interference with breathing which, when excessive, becomes stridulous in character—the stridor indicating mechanical obstruction of larynx or trachea. The voice is not very characteristic. It may be faint or of a muffled character, though perhaps with some effort in phonation, but it generally remains clear, following the law of subglottic stenosis as compared with the various types of hoarseness indicating laryngeal involvement.

Tracheal dyspnea has some characteristics peculiar to itself. It is inspiratory in character, the inspiration being longer than expiration. It may be of a noisy, labored, wheezing nature; becomes at times audible at a considerable distance, but it has not the peculiar brassy, croupy, stridulous sound of laryngeal dyspnea. The wheezing sound may sometimes be felt as a thrill.

In tracheal stenosis, the motion of the larynx remains almost stationary, being quite in contrast to laryngeal stricture, where the larynx makes profound excursions up and down in efforts at breathing. The phenomenon was first pointed out and emphasized by Gerhardt (9), (10).

During the preparation of this discussion, the writer has had the opportunity of observing this phenomenon as it concerns the larynx, to a marked degree, in the case of a patient with a bilateral abductor paralysis, who in all efforts to breathe would cause the larynx to make most prolonged and violent excursions. Whether the character of the laryngeal obstruction causes any accentuation of this phenomenon, I am unable to say. Gerhardt also pointed out the fact that in tracheal stenosis the head is either kept in the upright position or bent forward; while in laryngeal dyspnea the head is thrown back. My observations have been that the tendency to the forward bending of the head becomes more prominent the lower the stenosis is in the trachea, reaching its fullest bending in bronchial stenosis or spasms, as seen in the position of the asthmatic patient.

Auscultation of the chest is only of importance as distinguishing tracheal stenosis from unilateral bronchial stenosis, in that in the latter instance the vesicular murmur is absent or diminished on the side affected; but if there be bilateral absence of murmur, the stenosis may be in either the trachea or located at the bifurcation.

Demme (11) alludes to the fact that in long-standing tracheal stenosis the circumference of the upper portion of the thorax is diminished in measurement.

While the above phenomena include the salient features of tracheal stenotic symptoms, subjective and objective, there may be other associated symptoms, as for instance, the frequency of changes in pulse rate and distension of cervical veins, depending on the degree of external pressure and the implication

of the pneumogastric nerve. Paroxysmal attacks of suffocation may supervene, but they are not so constant a factor as in laryngeal stenosis.

Aufrecht (12) reports a new symptom of tracheal stenosis. In three cases of stenosis of the trachea, the author was able to observe a symptom which had not been· as yet described in this connection. When the stethoscope is applied to the trachea, immediately above the sternum, the very rough bronchial breathing which in the normal condition is invariably perceptible during the entire time of inspiration and expiration, was found to be replaced by a short, low, soft breathing, or was entirely inaudible. The detail for the reasons is fully described in the article.

We are greatly indebted to Gerhardt (13) for the most complete exposition of tracheal stenosis, and I quote from him in his attempt to formulate its stages, of which he recognies three.

"1st. Almost entirely free from disturbance, labored respiration coming on only upon physical exertion.

2nd. A stage of continuous and well marked stenosis which may extend over a great length of time, and which presents almost all the symptoms occurring in stenosis of the larynx, especially the audible respiration sounds, the form of respiration and its relative prolongation. The voice of the patient is weak in this stage and of limited volume.

3rd. Is apt to appear very rapidly. It commences with a paroxysm of suffocation which soon passes over and from which the patient apparently recovers. Nevertheless, the paroxysm recurs after a shorter or longer interval, and the patient either dies in this paroxysm or succumbs to a rapidly extending pneumonia of respiration."

Riegel very truly comments that although every case of tracheal stenosis by no means passes through these three stages in the order given, still this may be regarded as the normal course in the majority of cases.

DIAGNOSIS.—Though the symptoms above enumerated direct our attention at once to the trachea, it is fortunate that we are not entirely dependent upon these subjective symptoms in order to substantiate our diagnosis, for we have at our command facilities for examination which, in practically all cases, make the diagnosis a matter of certainty. It goes without saying that any decided external manifestation of pressure will

at once account for the stenotic symptoms. When these mani-
festations are not present, we have the use of the laryngeal
mirror, which, in nearly all instances, will bring the entire
tract under view and will at once give us the extent of laryn-
geal involvement in its association with the trachea.

The X-ray is most invaluable, especially as to accurately
locating dense tumors and foreign bodies, and bronchoscopy,
as at present perfected, leaves little to remain in the way of
perfecting our information. One thing must always be re-
membered, which undoubtedly has been the experience of
us all, that, in depending upon the laryngeal mirror, we have
always found on operation a greater extent of stenosis than
the picture of the laryngoscope seemed to indicate. This is
especially so in malignant cases.

TREATMENT.—Perhaps in no other condition can we bet-
ter employ the broad saying that the first element of treat-
ment depends on the recognition of the cause. Especially is
this so as it pertains to the external compression type of cases—
where the proper surgical treatment, serum or glandular ther-
apy at once suggest themselves. This same axiom applies
to the removal of the intratracheal growths and foreign bodies;
and if syphilis be the cause, the administration of potassium
iodid and mercury.

But in a certain number of cases, those of pure internal
strictures, treatment must be directed to the relief or eradica-
tion of the stricture itself. For this purpose we have at com-
mand tracheotomy, tracheal fissure, with exsection of the
stricture tissue, resection of that portion of the trachea which
includes the stricture, and, finally, the various forms of dilata-
tion.

Tracheotomy as a sole measure should only be resorted to
when it is conclusive that no other surgical means can be em-
ployed. It must, however, be used in a large proportion of
cases as a life-saving measure in cases of emergency, and as
a preliminary measure to dilatation when the stricture cannot
be reached through the larynx—and under these circumstances
should be made as high up as the nature of the stricture will
allow.

It sometimes occurs that the extent and deep location of
the stricture is determined only when tracheotomy has been
performed for the relief of dyspnea and we find that the oper-

ation has been unsuccessful. In these cases it becomes necessary to supplement the tracheotomy by the passing down of long flexible catheters through the tracheotomy tube in order to produce the desired effect. These cases are in their nature very extreme in type and subsequently prove fatal. I have, though, seen such instances, one (14) a case of deep aneurism pressing on the trachea at the bifurcation; and another, unpublished, due to a chain of deep cancerous glands, alternately pressing on the trachea, in which the urgent dyspnea was almost the first indication of their presence.

Resection of the stricture tissue itself may sometimes be possible in suitably situated or limited cases, either through fissure of the trachea or by means of the bronchoscope, subsequent dilatation being necessary for permanent cure.

Resection of the trachea is advocated by O. Frankenberger (15) as the only radical treatment for all strumous stenoses and all chronic stenoses, which include but a limited portion of the trachea, and he reports two successful cases as done by Küster.

It is the general consensus of opinion that the best treatment of internal tracheal stricture is by some form of dilatation, and I think we can say without contradiction that the best method is that based on the principles of O'Dwyer's form of intubation. If the stricture be not very high up in the trachea, it may be possible to produce dilatation through the larynx by intubation without tracheotomy, but in the vast majority of cases of tracheal stricture it becomes necessary to do a preliminary tracheotomy in order to carry out subsequent dilatation. If it be elected to use intubation after tracheotomy, the tracheotomy should be performed as high up as possible, so that the end of the intubation tube can pass below the tracheotomy opening as far as possible in order to be better retained. If we find that the intubation tube cannot be well retained, then the retention device of Dr. John Rodgers, reported by the writer, may be used (16).

Intubation, either with or without tracheotomy, is better indicated for long and sustained periods of dilatation. The hard rubber form of tubes will meet with all requirements, and are, I think, generally speaking, better than metal. It may be necessary to do some form of preliminary stretching of the stricture before the full value of intubation can be obtained. I think we should always endeavor, as far as possible, to em-

ploy the permanent method of intubation where it can be accomplished. In a certain number of cases, intubation by O'Dwyer's method may be impracticable—in those instances we have the well-known methods of Schrötter, and the glass chimney canulas, as first introduced by Mikulicz, the details of which are fully described by Kümmell (17). Soft rubber chimney canulas, to meet certain conditions, are also described by the same writer.

Schmieder, in a detailed and illustrated article (18), refers to the use of Dupuis' chimney canula, Schroeter's wedges, Thost's wedge canula and a chimney canula proposed by Schimmelbasch, and successfully used in Bergmann's clinics; also to a long canula in the shape of a horizontal T. These various forms are intended to meet various peculiarities of strictures which may arise. Schmieder emphasizes the necessity of the early use of these dilating measures in order to save the more extensive future operation of exsection, etc.

REFERENCES.

(1) Transactions Am. Laryngological Ass'n, 1905. Dr. John Rodgers.

(2) Chiari, O. Die Kranheiten der oberen Luftwege.

(3) Ziemssen. Vol. IV, p. 478.

(4) Demme-Zeimssen. Vol. IV, p. 478.

(5) Zeimssen. Vol. IV, p. 478.

(6) Loc. cit.

(7) Loc. cit.

(8) Schroetter, H. v. Deutsch. med. Wochenschrift. July 11, 1901.

(9) Ueber syph. Erkrank. Deutsches Archiv. f. klin. Med., Bd. ii, p. 535.

(10) Lehrbuch der Auscultation und Percussion. Zweiter vermeherte aus verbesserte Auflag. Tubingen, 1871, p. 219.

(11) Ueber Stenose de Trachea. Würzburg med. Zeitschrift. Bd. ii.

(12) Aufrecht. Centralb. f. innere. Med., No. 1, 1897.

(13) Loc. cit.

(14) Recurring Dyspnea after Tracheotomy. Dr. John Rodgers. N. Y. Medical Record, April 27, 1900, Vol. 59.

(15) Ann. des Mal. de l'Oreille, etc., May, 1901.

(16) Transactions of Am. Laryngological Assn'n, 1901.

(17) Archiv. f. Laryngol. und Rhinol., Vol. IV, 1896.

(18) Munch. med. Wochenschrift, January 9, 1906.

In addition to the references above mentioned, the reader is referred to the following:

Keen and Jones. Phil. Med. Journal, June 10, 1889. Two cases of tracheal obstruction.

Downie. Brit. Med. Jour., October, 1889. Three cases of syphilitic ulceration.

Sabrazes and Cabannes. Rev. Hebdom. de Laryngol., November, 1898. Case of tracheocele.

K. Huhn. Centralb. f. Chirurgie, No. LV, 1902. Treatment of tracheal stenosis, with a special consideration of retrograde intubation.

Killian. Archiv. f. Laryngol. und Rhinol., Vol. XII. A case of fatal sarcoma with stricture.

Löhrer. Munch. med. Wochenschrift, No. XXVII, 1904. A case of complete obstruction of the trachea by caseous and resolving bronchial lymph nodules after perforation into the right bronchus.

Schmieden. Mediziniche. Klinik., No. 34, 1905. Treatment of tracheal stenosis.

Laurens. Chirurgie Oto-Rhino-Laryngologique, 1906. Strictures of larynx and trachea, with special reference to treatment.

Niehus. Centralb. f. Chir., No. 31, 1903. Treatment of laryngeal stenosis and tracheal defects.

FOREIGN BODIES IN THE TRACHEA AND TRACHEOSCOPY.*

By A. Coolidge, Jr., M. D.,

BOSTON.

The proper treatment of a case in which a foreign body has been inhaled into the trachea has been discussed periodically in medical literature for a century. A very large number of cases have been reported, the foreign bodies including an enormous variety of objects. The symptoms offer almost as much variety, from instant death to practically no symptoms at all. The diagnosis of a foreign body in the trachea or bronchus is not always easy. The history may be misleading. If it is in the trachea, it seldom remains long in one place. There is generally much respiratory irritation, cough, spasm of the glottis, sometimes a rattle as it moves up and down. It seldom stays long in the trachea, it is either expelled or drawn into a bronchus. If in a bronchus, there may or may not be dyspnea, cough, pain in different parts of the chest, either constant or periodic. The foreign body, unless it obstructs the passage of air, may produce little or no irritation, but will ultimately cause local infection and consequent symptoms.

The diagnosis may be made positively by inspection with the bronchoscope, or if it is an inorganic substance by the X-ray, or it may be made probable by physical signs.

The prognosis, if a foreign body has been inhaled, depends upon the nature of the body, the condition of the patient and the possibility of proper treatment. The nature of the body will determine the distance that it can penetrate into the bronchial tubes, the amount of trauma or sepsis which it will cause and the ease with which it can be detected and removed. The condition of the patient may be seriously affected if air has been cut off from any part of the lungs, if much irritation be produced or if there is serious sepsis. On the other hand,

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foreign bodies have not infrequently remained for months or even years in the air passages, and have finally been expelled or removed, but they almost always cause or keep up more or less infection, which either slowly weakens the patient or by an exacerbation becomes fatal. When the foreign body is expelled or removed, the patient, unless in a very serious condition at the time, generally entirely recovers.

The important questions for the responsible physician, after considering the nature of the foreign body, its probable position and the condition of the patient, must always be, first, what is the danger of leaving it alone; second, is the patient's chance better or worse if an attempt is made to reach and remove it by operating, and, third, what operation shall be done. While the answer to the last two questions has, I think, materially changed within the last few years, the answer to the first, what is the danger of leaving it, is the same as it has always been.

To review this question briefly, I will quote from a few monographs in which the writers have collected statistics from series of reported cases. Roe, in 1893, found that the mortality in the cases which he collected was about 30 per cent where no operation had been done.

The writer justly says that statistics are misleading if we do not take into consideration the various conditions affecting them. A number of cases in which seeds or other small objects are inhaled and subsequently expelled might or might not reach the compiler of statistics, with a consequent lowering or raising of the death rate. If we infer from reported cases that the mortality is about 30 per cent, we exclude many cases in which a small body is inhaled and subsequently expelled by coughing. Including all cases of foreign bodies inhaled into air passages collected by Durham, Gross, Weist and Roe, in which no operation was done, a total of 1,417, there was a mortality of 27 per cent.

Wood studied the pathology of foreign bodies in the lungs, both from clinical records and by experiments on animals. He collected from German and English literature, dating from 1878 to 1879, eighty-nine cases of foreign bodies entering the lung through the upper air passages, and finds a mortality of 34 per cent, a figure which agrees closely with those already quoted. From an analysis of these cases, he concludes that: where an extraneous object has entered a bronchiole

through the trachea, it will be spontaneously expelled in about 57 per cent of the cases, and if this takes place the almost absolute tendency is towards recovery.

The diseases resulting from the entrance of foreign bodies into the lung through the air passages are abscess, pneumonia, bronchitis and gangrene. If the foreign body is not contaminated with especially virulent organisms, or is so formed as not to cause solution in the continuity of the mucous membrane, or does not block off the air from the lobe supplied by the bronchus in which it lies, it may be possible for it to remain in situ in the bronchus for a considerable length of time without producing any pathologic changes. The extent and malignancy of the lesions are dependent chiefly on the character and virulency of the bacteria with which the foreign body is contaminated. The shape and size play an important role, but still a secondary one to that of the microorganisms. A substance which is capable of disintegration causes much more extensive lesions than a smooth, stable substance.

The proper methods of treatment of inspired foreign bodies have, I believe, been so changed in the last few years by the introduction of direct tracheotomy and bronchoscopy, that it is unnecessary to discuss the old operations, or attempts to reach and remove the offending body. Since the endoscope of Bozzini in 1807, the introduction of endoscopy applied to different cavities of the body has been slow, and for years treated as an interesting rather than a practical proceeding. Its perfection could only be attained after the introduction of suitable illuminating devices, practical instruments and, to a less extent, anesthetics. But even after the possibility of proper apparatus it was some years before it was commonly appreciated that certain apparently crooked passages are not necessarily bars to the passage of straight instruments. The trick of sword swallowing is an old one, and is probably the source of inspiration for the esophagoscope. Bevan and Kussmaul in 1868, Mikulicz, Stoerk and Morell Mackenzie in 1881, and later many other observers, saw the interior of the esophagus, and occasionally, sometimes by mistake, entered the trachea instead.

A history of bronchoscopy would necessarily include the history of esophagoscopy, which has long been established as a practical medical procedure. Tracheoscopy and broncho-

scopy may now also be said to have passed their introductory
stage and to have become one of the accepted and established
proceedings of medical or rather surgical practice. The credit
for this is largely due to Killian. He adapted the esophago-
scope to the trachea and bronchi, he made use of the work
already done by von Schroetter and Pianiazek, and of the auto-
scope and illuminating apparatus of Kirstein, he first re-
moved foreign bodies from the bronchi through the natural
passages, and he perfected and published details of instruments
and technic which made easy the way for others to follow
him. The treatise by von Eicken, Killian's assistant in Frei-
burg, which appeared in 1903, covered the subject so com-
pletely at that time that, although I shall quote from it freely,
I will refer the reader to it for a history of bronchoscopy and
for many details.

The principles of tracheoscopy and bronchoscopy are very
simple. They consist in straightening out certain angles or
corners by means of a stiff straight tube, through which the
work is done under direct inspection. There are two of these
angles, the straightening of either one of which will allow
direct inspection of the bronchi, one through the natural pass-
ages by passing a tube through the mouth, pharynx and
larynx into the trachea, the second through an artificial open-
ing directly into the trachea after a tracheotomy. Thus we
have upper and lower bronchoscopy, which must in many re-
spects be considered separately.

Turning to the practical value of tracheoscopy or broncho-
scopy for the removal of foreign bodies which have been in-
haled and impacted in the trachea or bronchi, we find that the
old methods of groping blindly in the dark, often unsuccess-
fully and sometimes causing serious trauma, have been re-
placed by comparative accuracy, certainty and slight injury
to the patient. Of the cases collected by Roe, combining his
statistics with those of Durham, Gross and Weist, a total of
1,234 cases in which previous to the introduction of broncho-
scopy operations had been done, there was a mortality of 22
per cent. On the other hand, in the reports of 50 cases which
I have been able to collect of removal of foreign bodies, twenty
by upper and thirty by lower bronchoscopy, the mortality was
four, or 8 per cent, three of the fatal cases being in a seri-
ous condition at the time of the operation. Also, the proba-
bility of finding the foreign body by bronchoscopy, and the

large chance of not recovering it after the old operations, must be considered in advising operation.

The ideal method of extracting is with the aid of upper bronchoscopy. This requires a hollow tube, proper illumination and an extracting instrument. Kirstein's autoscope made possible the direct inspection of the deep pharynx and larynx, and Killian's tube spatula made it easier to see and reach the interior of the larynx. Guided by these, Killian in 1897 passed a long tube through the glottis and trachea into a bronchus and extracted a foreign body. He then made a series of tubes of different calibres and lengths, with extracting and other accessory instruments, all of which are in common use today. The tubes are slightly bell shaped at the end, and are graduated so that the operator can see at a glance the distance to which the tube has penetrated. No stilette is used. If the trachea only is to be explored, it is seldom necessary with adults to use general anesthesia. The pharynx, epiglottis and larynx are thoroughly cocainized before the introduction of the tracheoscope, and after its introduction the trachea is also cocainized through the tube. With children or nervous adults, or in case the bronchi are to be explored, it is usually necessary to give a general anesthetic. When cocain only is used, the patient is seated on a low chair with the head thrown well back. All clothing around the neck should be removed. If under a general anesthetic, the patient is on his back with his head over the end of the table. That the passage of the tracheoscope with cocain anesthesia does not require an exceptional patient nor prohibitive skill on the part of the operator, is proved every day in different clinics, especially in Germany, where tubes are introduced as routine into the esophagus and trachea.

The tube is passed under direct inspection. This may be aided, especially when the longer tubes are used, by bringing the larynx into view with Kirstein's autoscope or Killian's tube spatula, and passing the autoscope through this. As the glottis is reached, the patient is told to take a deep breath and the tube is passed between the cords and downwards through the trachea to the bifurcation. In case it is necessary to enter one of the bronchi, this also is done after cocainization under direct inspection. For the exploration of the bronchi, the tube should be long enough to reach from the upper incisor teeth to the middle of the sternum; that is, in adults from 30 to 35

centimeters. A bronchus is capable of considerable movement or bringing into line by the bronchoscope, so that it may be searched through its primary or even its secondary divisions. In this case a perforated tube must be used, to maintain the respiration in the other bronchus. For the removal of foreign bodies from the bronchi, says Killian, a good view, great care and quietness in procedure are essential.

There have been but few modifications of Killian's bronchoscopes, and it would seem difficult to improve on them. In order to maintain respiration in the other bronchus, Ingals made a spiral series of smaller perforations instead of the larger ones of Killian. Jackson has combined the small accessory tubes and small lamp and the stilette of Einhorn's esophagoscope with Killian's tubes. The lamp I shall speak of later. The stilette will appeal to many in passing the tube into the esophagus, and even for the larynx the author quotes Ingals as preferring the sense of touch on account of experience gained in intubation. The stilette must, of course, be immediately withdrawn as soon as it reaches the interior of the larynx. When the air passages are invaded, either by a foreign body or by instruments, there may be a reflex respiratory inhibition which under certain conditions may be serious. This has been studied by Crile, who advises that a general anesthetic should not be used unnecessarily. If it is used, it is well to give a hypodermic injection of atropin to protect the circulation and to cocainize locally. In one of my cases, previously reported, the patient stopped breathing when the bronchoscope entered the left bronchus, and artificial respiration was necessary.

After the tube, the next essential is proper illumination. Much has been accomplished by a head mirror and reflected light. This is practical enough with a short tube of fairly large calibre. As it becomes longer or of smaller calibre, reflected light becomes fainter and harder to manage. The least movement on the part of the patient or the observer throws it out of adjustment. The absence of any other method of illumination might make it advisable to abandon upper and resort to lower bronchoscopy. Its greatest advantage is that it is always available and in working order. The source of light used by Killian is generally the head lamp of Kirstein. As the operator carries the light about with him it is not thrown out of adjustment by movements of the tube.

In the electroscope of Caspar, a reflecting mirror with a small hole for the observer's eye is placed just in front of the entrance to the bronchoscope. It gives a better light than the head lamp for inspection or diagnosis, but is in the way if instruments are to be passed down the tube. It requires the same electrical current as Kirstein's head lamp. A small lamp at the distal end of the tube gives an illumination which has certain advantages. This was used by Einhorn in his esophagoscope. Ingals first removed a foreign body by its use in a bronchoscope. The light is not obstructed by instruments on their passage down the tube, it dispenses with head apparatus and darkened rooms. The electrical current required is easily obtained, three or four dry cells or even ordinary wet cells such as are used for ringing door bells will suffice. It is, of course, a delicate apparatus which must be kept in order, and there is perhaps danger of breaking or losing the lamp in the bronchus, especially if it is simply suspended in the bronchoscope. If the lamp with its carrying rod is in a separate compartment, as in Einhorn's and Jackson's instruments, it is much better protected. With this arrangement secretion entering the end of the tube will cover the lamp and the light will either disappear or become dim, and reappear again as the secretion is removed. This happens frequently in the esophagus.

The third essential for extracting foreign bodies by direct inspection is an instrument which can be used through the tube. One form of instrument will not be sufficient for all objects. The most frequently useful will be a forceps with blades of different shapes for seizing. These are made long and narrow and on the general principles of Schrötter's laryngeal forceps. Killian's extracting forceps are made with the blades attached to the tube, through which runs a wire, on the end of which is a broken ring, which closes the blade when it is pushed down upon them. He also has hooks of different shapes for holding objects which are not readily grasped. An instrument designed especially for the removal of a collar stud was made by Morton in Killian's clinic. It is in the general shape of tube forceps, the tube carrying a right angled roughened hook which is passed under the bottom of the stud, a sharp pointed piece of metal is then pushed down, holding the stud firmly between its point and the hook. A year ago, I had a forceps made in which the handle is attached at right

angles to the central shaft carrying the blades, giving a firm hold to the hand. The barrel or tube surrounding the central shaft is pushed down onto and closes the blades by the action of a trigger operated by the forefinger, the rest of the hand maintaining a firm hold on the handle. The operator is thus able to look along the shaft of the instrument without bending it, and to control the farther end under direct inspection. The central shaft is screwed into the handle so that it can be adjusted to open in any direction, and as the blades are closed by pushing the barrel onto them, not by pulling them into the barrel, they do not draw away from the object to be seized at the moment of grasping. A somewhat similar forceps was designed by Stark. For lower bronchoscopy, where the distance is often short, I have found long thin alligator forceps, such as is described by Willis, a very convenient form.

Magnets have been suggested by De Roaldes, Jackson, MacIntire, von Schroetter and many others, and have been used for extraction by Garel, Guisez and Thost. Their use is more limited than at first thought might appear. Not only is a special and more or less elaborate magnet required, but the foreign body must be of iron and free to move, in which case it could often be easily and more accurately extracted with forceps. It would be especially useful if a small iron body had become lodged in a small bronchial tube beyond the range of vision, or if a number of small pieces of iron, such as iron filings, had been inhaled, or if the body were of such a shape that it could not be seized by forceps or hooks.

Secretion may give much trouble by being blown out through the tube or by obstructing the view. Coughing may often be stopped by better local or general anesthesia. If secretion hides the field, it may be sponged with cotton or sucked out with Killian's pump. Great care must be taken that the cotton used in sponging is not left in the bronchus. It should be securely locked on to the carrier. I have made and used a carrier in which the blades which seize the cotton are locked by a collar which screws down upon them.

Upper bronchoscopy is, of course, the ideal method of extraction of foreign bodies. The passage of the bronchoscope involves little danger, no after-treatment, no scar. Nevertheless, lower bronchoscopy is an operation of greatest value, and one which should be widely published and generally understood. The upper route is theoretically more liable to lead

to infection of the lower air passages than tracheotomy, because the tubes must necessarily come in contact with the mouth and pharynx. Experience, however, does not seem to prove this danger. There is danger in infants that the trauma to the larynx may cause serious edema; such cases have been reported by Nehrkorn and von Schroetter, but in adults this danger is slight. As a general rule in cases of emergency, tracheotomy should be done. If the object is free in the trachea it will often be expelled through a tracheotomy wound, whereas delay might allow it to become impacted in the larynx or lost in a bronchus. Tracheotomy would probably be indicated also if there were dyspnea or collapse, or if the patient's strength were limited and for any reason the search were likely to be prolonged or difficult. It seems to me that the resulting scar after a tracheotomy is to be considered to a certain extent, and that it would be justifiable to persist in the attempt through the natural passages before opening the trachea longer in the case of a young woman or girl than in a man or boy. In a certain number of cases the object cannot be reached through the natural passages, or the attempt would involve more danger than the added danger of tracheotomy. And also for some time to come, the treatment of inspired foreign bodies must often be undertaken without an equipment of elaborate instruments, and by men who have had no experience in the matter.

While it must for some time be only the man especially equipped who will be able to remove a foreign body from a bronchus through the natural passages, a little knowledge will enable many provided only with a short hollow tube, a long pair of forceps and a head mirror to save the lives of their patients, with no more danger than is involved in the tracheotomy. The one important fact upon which the operation is based, and which should be demonstrated to every surgeon, is that after a tracheotomy a straight tube may easily be passed through the wound, turned at right angles and pushed down the lower section of the trachea. If necessary, by using a perforated tube, it may be continued for some distance down either bronchus. Through the tube the foreign body can generally be seen and seized. In reading reports of foreign body extraction published before this most simple method was suggested, we find the operator fishing in the bronchi with forceps and hooks and even cork screws, often unsuccessfully,

whereas in many of the cases the object would have been easily found and removed by direct inspection.

In my experience, cases of foreign body in the air passages are not very frequent, but foreign bodies in the esophagus are more so, and in many respects involve the same problems and are reached by the same instruments, as in upper broncho- scopy. I have already reported before this association five cases in which I have removed foreign bodies from the bronchi. I should like now to report three more which illustrate cer- tain points.

T. L., a boy aged 8 years, was referred to me by Dr. Leland, April 1, 1905. Eight days previously he had inhaled a prune stone, followed by cyanosis and struggling, lasting many min- utes. He has since had similar but less violent attacks. He had periodically considerable pain in the chest, at first on the right side, later over the whole front. When seen, he had periodic, severe attacks of coughing, a little purulnt expectoration, occasionally with blood, diminished breathing on the right side and coarse rales on both sides; temperature, 100 to 103. The X-ray showed nothing. Killian's tube was passed to the bifurcation, through the upper passages, under ether, but the amount of secretion prevented a satisfactory view. Two days later, the conditions being the same, I did trache- otomy below the isthmus of the thyroid, and a short tube was passed into the right bronchus. After sponging much muco- purulent material, the stone was seen with the edge present- ing, impacted low in the right primary bronchus. I seized it with my forceps, but it was so firmly held in place by the swollen mucous membrane that it was a considerable time, using all the force that I dared, before I could dislodge it. The patient's temperature after the operation at once fell to normal, and he made an uninterrupted recovery. This case is interesting as showing that a foreign body may become so firmly held by its own swelling and that of the mucous mem- brane as to cause a serious obstacle to removal. It also shows, as has been often noted before, that even considerable in- fection in the lung, accompanied by a certain amount of trauma, will often disappear immediately as soon as the offend- ing object is removed.

The second case may be considered as typical of the value of upper bronchoscopy.

J. D., a boy aged 9 years, entered the hospital Oct. 2, 1905.
Three days before, while playing, he had inhaled a shingle nail.
There was severe coughing and choking at the time, which has
continued periodically since, with a feeling of discomfort in
the sternal region. There has been no blood nor dyspnea.
The X-ray showed the nail apparently in the left bronchus, just
below the bifurcation. The next day the child was etherized,
after subcutaneous injection of atropin, placed on a table with
the head over the end, the larynx cocainized through the auto-
scope and Killian's tube passed through the glottis and down
to the bifurcation. The illumination was by the small lamp
at the distal end, after Einhorn's model. The nail was seen

Foreign bodies removed.

in the left bronchus point up and removed at the first attempt
with Killian's forceps. The patient had no further symptoms.
In a case of this kind the value of upper bronchoscopy is man-
ifest. The necessity for a general anesthetic might be ques-
tioned. This as well as the question of the upper or lower
method must be left to the operator, and must depend upon
the patient and the probable difficulty to be encountered in
reaching and removing the foreign body.

The third case was a girl aged 2 years 3 months, seen May 30, 1906. Four days previously she had inhaled a hook, such as is attached to an eye on clothing. At the time there was violent respiratory spasm, and a little dyspnea. There has been paroxysmal cough since. The X-ray showed the foreign body just below the fifth rib a little to the right of the vertebral column. Under ether, a Killian tube of small diameter lighted with the small distal lamp, was passed into the larynx. There was a slight subglottic swelling, especially on one side, and the glottis appeared to be just too small to admit the tube easily. Fearing subsequent laryngeal swelling if I persisted, I abandoned the upper route, did tracheotomy and through a short tube immediately saw and removed the foreign body from the right bronchus. There was a little muco-purulent secretion surrounding the hook at the time of its removal, but not enough to cause any trouble. The child is now, two weeks later, doing well.

In this case I think I could have removed the foreign body by upper bronchoscopy, but recalling the experience of Nehrkorn and Schroetter in cases of infants, referred to above, it seemed to me safer to take the lower route.

REFERENCES.

Bevan. Lancet, 1868, p. 470.
Bozzini, Ph. Weimar, 1807.
Chiari, O. Krankheiten des Kehlkopfes und Luftröhren, 1905.
Coolidge, A. Boston Med. and Surg. Jour., May 25, 1905.
Coolidge, A. New York Med. Jour., September 30, 1899.
Coolidge, A. Boston Med. and Surg. Jour., October 13, 1904.
Crile, G. W. Med. News, January 27, and February 24, 1900.
Eicken, Carl von. Die klinische Verwertung der direkten Untersuchungsmethoden der Luftwege. Archiv. für Laryngol., 15 Bd. 3 Heft.
Eicken, C. von. Deut. med. Woch., No. 23, 1903.
Eicken, C. von. Beiträge zur klin. Chir., 1902, Band XXXIV.
Eiborn. Berlin klin. Woch., 1902, No. 51.
Germain, H. H. Jour. Am. Med. As., July 8, 1905.
Gleitsmann and Mayer. Laryngoscope, April, 1905.
Guisez. Bull. et mem. de la Soc. Med. d'hopitaux de Paris, Dec. 23, 1903.
Ingals, E. F. Jour. Am. Med. As., Nov. 19, 1904.
Ingals, E. F. Jour. Am. Med. As., May 27, 1905.
Jackson, C. Laryngoscope, April, 1905
Killian, G. Münch. med. Woch., 1899, No. 32.
Killian, G. Münch. med. Woch., 1898, No. 27.
Killian, G. Archiv. für Lar., XIII-1.
Killian, G. Jour. Lar. Rhin. and Otol., September and October, 1902.

Kirstein, A.   Archiv. für Lar., III Bd. Heft., 1 and 2.
Kirstein, A.   Berlin kl. W., 1895, No. 22.
Kollofrath.   Münch. med. Woch., No. 38, 1897.
Macintire, J.   Jour. Lar. Rhin. and Otol., September, 1902.
Mackenzie, Morell.   Med. Times and Gazette, 1881, vol. 2, p. 60.
Meyer.   Berlin klin. Woch., September 11, 1905.
Mikulicz, von.   Centralb. für Chirurg., 1881, No. 43, p. 673.
Morton, W. C.   Jour. Lar., Rhin. and Otol., January, 1906.
Nehrkorn.   Deutsch. med. Woch., September 29, 1904.
Pianiazek.   Muench. med. Woch., 1898, p. 723.
Roe, J. O.   Burnett's System of Diseases of the Nose and Throat, Phil., 1893.
De Roaldes, A. W.   Trans. Louisiana State Med. Society, 1900.
Schroetter, L. von.   Zur Casuistik der Fremdkörper in den Luftwegen, 1901.
Schroetter, L. von.   Münch. med. Woch., 1905, No. 26 and 27.
Stark, H.   Die direkte Besichtigung der Speiseröhre. Oesopha-goskopie.   Würzburg.   A Stubers Verlag, 1905.
Stoerk.   Münch. med. Woch., 1881, pages 210 and 706, 860.
Stillman, F. L.   Ohio State Med. Jour., March, 1906.
Thost, A.   Monatsch. für Ohrenheilk., 1905, No. 4.
Wild.   Beit. z. klin. Chir., XLV, 1.
Willis, M. W.   Lancet, December 10, 1904.
Wood, G. B.   Phil. Month. Med. Jour., June, 1899.
Yankauer.   Laryngoscope, April, 1905.

LII.

A STUDY OF THE ANATOMY OF THE ACCESSORY CAVITIES OF THE NOSE BY TOPO-GRAPHIC PROJECTIONS.*

By Hanau W. Loeb, A. M., M. D.,

PROFESSOR OF DISEASES OF THE NOSE AND THROAT IN ST. LOUIS
UNIVERSITY,

ST. LOUIS.

(*From the Anatomical Department of St. Louis University.*)

An accurate comparison of the nasal accessory sinuses of man with one another, and with those of other human heads, has not been possible with the methods in vogue up to the present time. A large degree of error is to be expected in view of the great variety in numbers, form, size and relations, and the difficulty of establishing a definite standpoint for comparison. It is for the purpose of approaching the solution of this problem that this study has been undertaken.

Our knowledge of the morphology of the accessory sinuses has come to us from investigations made for many years, in many ways. One of the earliest methods was that of disarticulated bones, which naturally could give only an indefinite idea of the relations and but meager information of the size and shape.

Examination of the articulated skull possessed the advantage of retaining the sinuses in proper relation, even if they could not all be seen. An important step forward was the use of the articulated skull with portions cut away, so as to show the sinuses as they lie. A moderate understanding of the maxillary, frontal and the sphenoid sinuses may be obtained in this way, and, in specially prepared specimens, the ethmoid labyrinth may be fairly well observed.

*Presented before the American Laryngological, Rhinological and Otological Society, Kansas City, June, 1906.

A much better plan is to treat the head, with the soft parts attached, in this way. Before the method of decalcification was used, it was necessary to remove the bone with saws, chisels, etc., but with decalcification, an ordinary knife may be employed.

Corrosion preparations, when well made, show the volume and interrelations of the sinuses, supplanting the hollow form by a solid cast. But, of necessity, the specimen from which the preparation was made is destroyed and, hence, the exact relation of the adjacent parts cannot be fixed.

Radiography is of considerable service in demonstrating the outlines of the sinuses, under favorable circumstances.

Serial sections made in sagittal, coronal and horizontal ways show fairly well the relation, size and form of the sinuses, whether they be frozen and sawed, or decalcified and cut with a knife. The chief difficulty, as to comparisons, lies in the fact that it is impossible to secure sections of uniform thickness and of identical positions in a series of heads. As a consequence, the pictures at the level of the sections differ accordingly.

To overcome these difficulties, a plan is here proposed which follows logically the reconstructions as made by numerous biologists, and the work of Jackson* in the study of the relations of the body structures with serial sections, and that of Potter†, by means of which the internal organs of man are accurately reconstructed so as to show their topographic relations. Potter projected the organs in the anterior portions of the chest and abdomen on the anterior surface; those in the posterior portion, on the posterior surface; those on the right side to the right, and those on the left to the left.

Manifestly, while it is desirable to secure an accurate picture of the greatest diameter of the sinuses shown on the corresponding sides, laterally, anteriorly and superiorly, for the purposes of comparison, it is necessary to reconstruct both sets of sinuses on the one side, using the same projection plane; otherwise the comparisons would be full of errors and therefore valueless. On this account it became necessary to modify Potter's method in some particulars.

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*C. M. Jackson. "A Method of Teaching Rational Anatomy." Jour. A. M. A., September 21, 1901.

†Potter. "Topography of the Thorax and Abdomen." 1905.

Potter's method consists in projecting the organs on the surface of the body, as it were, by establishing a base line from which measurements are made on the surface of the section; in each section the extreme distances, centrally and peripherally, of the organ to be reconstructed, are taken from a line connecting the intersecting points of the base line on the surface of the sections, and these are properly designated on millimeter paper, upon which the outline of the body has already been accurately made and the base line accurately indicated. When this is done for the successive sections, the points designate where the upper portions of the section pass through the organs at the greatest and least distance from the base line, taken as zero. The course of the organ in the sections is shown on the millimeter paper after determining it by careful study, measurement and comparison.

PREPARATION OF THE SECTIONS.

The head used for the projections was that of a full grown man weighing about 150 pounds, about 5 feet 7 inches in height. It was first injected with a 50 per cent formalin solution, after the method of Jackson, and then immersed in a 3 per cent solution of hydrochloric acid for three months, by which time the bones were entirely decalcified. It was then moderately frozen and sectioned.*

The sections were made as uniform as possible in thickness, both as to different sections and the two sides of the sections.

It was found, that when an attempt was made to cut sections of a decalcified head, moderately frozen, there would be considerable sagging, due to the weight of the head upon the softened framework. Great care was necessary to obtain sections of uniform thickness, which is most essential.

For the purpose of reconstruction and projection, it is not material in what directions the sections are made—horizontal, sagittal or coronal—although the horizontal has been found the most satisfactory and convenient form.

Before the sections are made, the head is photographed, for the purpose of securing as accurately as possible right and

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*It is not necessary to freeze the head before making the sections, though this somewhat facilitates the process.

left profiles, and an anterior view. By the use of a rule, placed in the same focus as the head, it was possible to enlarge the photograph so as to secure a natural size picture. The markings which show on the photograph are important in designating the exact position of the sections.

A drawing of the top of each section is now made with India ink on an oblong piece of glass in a frame, care being taken to make the drawing lines directly parallel to the lines of the sections. From the glass it is redrawn on tracing paper. (See Pl. I to VI.)

While the projection can be made without these drawings, they are of great assistance in verification, by furnishing a control for each measurement made on the sections.

There is practically no displacement of the sinuses such as there is from the contracting effects of formalin on soft organs, as these are all encased in bony walls, which, although decalcified, still have a fairly firm framework.

ESTABLISHMENT OF THE BASE LINE.

The accurate projection naturally depends upon the correct establishment of the base line, from which the sinuses are to be measured. It is important where comparisons are to be made, that the base line should be more or less uniform for a series of heads, though this is not absolutely necessary. It goes without saying that the line on the sections and that on the projection must occupy the same relative position, otherwise the errors will be innumerable. The lines on the two sides of the head should be in the same plane, perpendicular to the horizontal basal plane of the head. When the sinuses are to be projected to the respective sides of the head, minor or even considerable deviations of the lines on the two sides of the head are of no significance, but where comparisons are to be made between the two sides from projections made on the two sides, the errors become at once manifest. To overcome this, it was found expedient to project first the left sinuses to the left side and the right upon the inverted left outline. The latter gives the proper picture for the projection of the right sinuses on the right side. The possibility of error can be easily calculated.
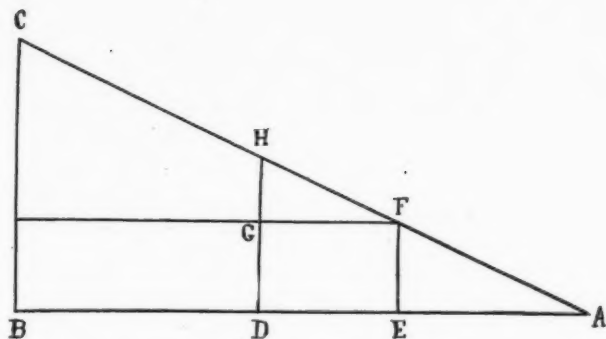
In the figure here shown, *ab* represents the line connecting the two correct base line points, and *c* the intersection of the incorrect base line with the section. *d* and *c* are corresponding points on the two sinuses to be compared on the two sides of the head. The extreme error would therefore be *gh*, and the lesser errors would be represented by lines parallel to *gh* lying between *g* and *f*, depending on the part of the two sinuses subjected to comparison. The following formula would therefore represent the error, $gh : cb = cd : ab$; wherefore,

$$gh = \frac{cb \times ed}{ab}$$

Given *cb*, or the distance between the true and the false base line as 1 cm. (far more than likely), the error in comparing the sinuses in the lateral projections is shown in millimeters in the following table, taking in each instance the section showing the greatest possibilities in this direction:

Sinus.	Section.	Greatest Error.	Least.	Average.
Maxillary	5	5.3	2.0	3.65
Sphenoid	4	2.1	−0.3	0.90
Frontal	1	2.5	0.	1.25
Anterior Ethmoid	3	1.7	0.6	1.15
Posterior Ethmoid	3	1.9	0.4	1.15

It is thus seen that, with the exception of the maxillary sinus, the error is insignificant, and whatever error there is in comparing the maxillary sinuses readily rights itself by the checks which adjacent structures force upon the projector.

In the anterior projection, the error would be much less, the maximum (the sphenoid) being only .04 mm.; in the superior projection, since the measurements are made with reference to both base lines, the error will be equal to that of the lateral or the anterior projection, depending on whether the lateral or the antero-posterior diameter be considered.

The lateral base lines have been drawn through a crease just anterior to the tragus of the ear, and the anterior through the middle line of the nose and occiput, measuring from the two tragi. The superior surfaces of the section were nicked with a knife just where the base lines intersected them, leaving marks so clear that notwithstanding the repeated handling of the sections they still persist. Marks made by ink or pencil did not survive long.

MEASUREMENTS.

The sinuses are measured with respect to their greatest and shortest distances from a straight line connecting the points of intersection of the two base lines with the superior surface of the section, taken as zero. To facilitate this, a frame has been constructed holding an oblong glass which is ruled with lines 1 cm. apart. One of the lines is placed so as to cover the two intersecting base line points, and the readings are taken posterior and anterior to the measuring line for the lateral reconstruction, and to the right and left for anterior reconstruction. The following are the figures obtained in millimeters:

ANTERIOR RECONSTRUCTIONS.*

LEFT.

Sections.	One		Two		Three		Four		Five		Six	
Profile.	84	..	79	..	78	..	74	..	74	..	71	..
Cranial Cavity.	70	0	71	0	70	0	65	0	5	03R	50	04R
Frontal.	01	18	01R	12	..	..	..	..	..	..	..	..
First Ethmoid	..	..	03	12	05	12	..	..	..	..	..	..
Second Ethmoid	..	..	..	..	04	13	..	..	..	..	..	..
Third Ethmoid	..	..	..	..	03	14	..	..	..	..	..	..
Fourth Ethmoid	..	..	..	..	03	08	..	..	..	..	..	..
Fifth Ethmoid	..	..	..	..	03	14	..	..	..	..	..	..
Sphenoid.	..	..	..	..	08R	13	02	17	..	..	..	..
Maxillary.	..	..	..	..	..	..	11	27	15	39	17	27
Ear.	..	..	..	..	88	..	..	..	..	..	..	..
Septum.	..	..	..	..	0	05	03	..	01R	..	..	..
Hiatus-Infundibulum. ..	..	..	..	..	02	05	..	..	05	15	..	..
Inferior Turbinate.	..	..	..	..	..	..	..	13	..	..	..	..
First Ethmoid Turbinate.	..	..	..	..	02	..	06	13	..	..	..	..
Second Ethmoid Turbinate.	..	..	..	..	02	..	10	..	..	..	..	..
Naso-Lachrymal Canal. ..	..	..	..	..	10	12	12	13	..	..	..	..

*All measurements are towards the corresponding side of the base line. Where there is any difference, this is indicated by R (right) and L (left).

RIGHT.

Sections.	One—		Two—		Three—		Four—		Five—		Six—	
Profile	77	:	78	:	77	:	75	:	70	:	68	:
Cranial Cavity	68	0	70	0	68.	0	64	0	56	03	48	04
Frontal	22	0	13	01L	:	:	:	:	:	:	:	:
First Ethmoid	:	:	:	:	10	06	:	:	:	:	:	:
Second Ethmoid	:	:	:	:	08	12	:	:	:	:	:	:
Third Ethmoid	:	:	11	09	:	14	:	:	:	:	:	:
Fourth Ethmoid	:	:	:	:	05	08	:	:	:	:	:	:
Fifth Ethmoid	:	:	:	:	03	07	:	:	:	:	:	:
Sixth Ethmoid	:	:	:	:	03	10	:	:	:	:	:	:
Seventh Ethmoid	:	:	:	:	05	14	:	:	:	:	:	:
Eighth Ethmoid	:	:	:	:	03	14	:	:	:	:	:	:
Ninth Ethmoid*	:	:	:	:	03	15	:	:	:	:	:	:
Sphenoid	:	:	:	:	:	:	14·	07L	:	:	:	:
Maxillary	:	:	:	:	:	:	25	12	38	14	30	18
Septum	:	:	:	:	02	:	05	14	:	:	:	:
Ear	:	:	:	:	86	:	:	:	:	:	:	:
Hiatus-Infundibulum	:	:	:	:	03	10	:	:	:	:	:	:
Inferior Turbinate	:	:	:	:	05	13	:	14	:	:	:	:
First Ethmoid Turbinate	:	:	:	:	02	:	05	:	:	:	:	:
Second Ethmoid Turbinate	:	:	:	:	02	:	08	:	:	:	:	:
Naso-Lachrymal Canal	:	:	:	:	09	11	12	14	:	:	:	:

*One ethmoid was not cut by the section.

LATERAL RECONSTRUCTIONS.*

LEFT.

Sections.	—One—		—Two—		—Three—		—Four—		—Five—		—Six—	
Profile	71	104P	75	105P	85	103P	95	102P	100	99P	84	89P
Cranial Cavity	54	93P	47	95P	28	93P	2	88P	12	80P	13	68P
Frontal	56	64	43	58								
First Ethmoid			51	61	47	56						
Second Ethmoid					37	50						
Third Ethmoid					33	42						
Fourth Ethmoid					33	37						
Fifth Ethmoid					19	33						
Sphenoid					8	26	2	23				
Maxillary							27	63	28	61	33	53
Ear					12P	38P						
Hiatus-Infundibulum					42	52						
Inferior Turbinate									31	63		
First Ethmoid Turbinate					43	54	32	52				
Second Ethmoid Turbinate					26	42	25	58				
Naso-Lachrymal Canal					57	61	56	58				

*All measurements except those marked P (posterior) are anterior to the base line.

RIGHT.

Sections.	One		Two		Three		Four		Five		Six	
	56	94P	47	95P	23	92P	21	87P	12	80P	13	67P
Cranial Cavity	56											
Frontal	56	66	45	62								
First Ethmoid					51	57						
Second Ethmoid					45	49	42	44				
Third Ethmoid					33	43						
Fourth Ethmoid					36	41						
Fifth Ethmoid					31	36						
Sixth Ethmoid					33	36						
Seventh Ethmoid					28	32						
Eighth Ethmoid					14	29						
Ninth Ethmoid												
Sphenoid							29	6P	26		37	55
Maxillary					25	33	26	63	26	60		
Ear					43	54						
Hiatus-Infundibulum									35			
Inferior Turbinate										62		
First Ethmoid Turbinate					43	55	31	53				
Second Ethmoid Turbinate					27	42	25					
Naso-Lachrymal Canal					56	62	55	58				

RECONSTRUCTION ON MILLIMETER PAPER.

A prominent line on the millimeter paper is taken as the base line and each section is indicated by measuring its thickness at the base line and at other points more or less fixed, and by measuring distances from spots shown on photographs of the head. A little practice makes this an easy matter. At the extreme ends, the lines indicating the section levels will curve on account of the perspective; however, ordinary care only is necessary, as the sinuses being centrally placed do not come into relation with the extreme anterior, posterior, right and left portions of the projection. Having projected the lines of the sections on the millimeter paper, they are delimited and the contour established by lines drawn through points on the millimeter paper, in accordance with the measurements of the outline; the particular form of the line connecting the points will depend on the boundaries of the section. This gives an outline of the projected surface with the sections indicated by lines and the base line properly projected.

In accordance with the measurements, points representing the proximal and distal points of each sinus are indicated on the line representing the superior surface of each section in which it appears.

With these points and adjacent structures and reconstructions as guides, the course of the sinuses through the sections is carefully noted and traced on the millimeter paper. (Pl. VII.) A little practice makes it possible to do this speedily and accurately, although it is confusing at first. It must be remembered, that it is possible to represent on the lateral projection only the antero-posterior and supero-inferior diameters, on the anterior projection, the lateral and supero-inferior diameters, and on the superior projection, the lateral and the antero-posterior diameters. In this way each diameter is duplicated in the projections, and is thereby controlled.

It is remarkable how speedily an error is discovered, for there is such an interdependence of the different lines upon one another that the slightest variation from the correct picture manifests itself with no uncertain demonstration. Of course, every part of the work is controlled by repeated verifications.

In making the superior reconstruction, the measurements made for both the lateral and the anterior reconstructions are

used and the points and lines are fixed by using the meas-
ured distances of these projections as co-ordinates. This is
somewhat difficult and puzzling at first, but the work soon
becomes simple, especially if the lateral and anterior projec-
tions are kept constantly at hand for comparison.

The plan used for the superior projection, which differs ma-
terially from that of the other projections, is always to be fol-
lowed when making a projection parallel to the sections.

We have, now, accurate lateral, anterior and superior pro-
jections of the various sinuses in their greatest diameters, in
proper relation to one another and to various other important
structures.

The Completed Reconstructions.

Having a correct picture on the millimeter paper, it is an
easy matter to transfer it to the tracing paper*, from which
it may be retransferred in whole or in part to other drawing
papers.

Through the medium of tracing paper, the sinuses with the
turbinates and other structures are drawn on white drawing
paper, the frontal sinuses being colored yellow, the sphenoid
green, the maxillary purple, and the ethmoids red, the anterior
group being lined horizontally and the posterior perpendicu-
larly. The turbinates, cranial fossae, naso-lachrymal canals
and the floor of the nose are represented by spaced black lines
and the contour of the head and the infundibulum, with the
hiatus semilunaris, in solid black lines. This makes it possible
for the eye to follow the outline of the sinuses and other struc-
tures without confusion.

The lateral reconstructions show the sinuses with all their
divisions, the turbinates, the floor of the nose, the anterior cran-
ial fossa, the naso-lachrymal canal, and the infundibulum with
the hiatus semilunaris. The location of the bulla ethmoidalis
is noted as the posterior boundary of the hiatus semilunaris.
(Pl. VIII and X.)

The anterior reconstruction shows the sinuses, the ethmoid
being differentiated into the consolidated anterior group and

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*I am now discarding the drawing on millimeter paper, as
it is far simpler and less time-consuming to make the drawing
directly on the tracing paper spread over the millimeter paper
as a guide.

the consolidated posterior group, as the overlapping would be confusing. The floor of the nose, the bony nasal septum, the turbinates and the naso-lachrymal canal are also shown. (Pl. IX.)

In the superior reconstruction, the sinuses are shown complete, the ethmoid being represented in all its divisions. The infundibulum, the naso-lachrymal canal and the attachment surface of the nasal septum to the nasal roof are also designated. (Pl. XI.)

RECONSTRUCTIONS FOR COMPARISONS.

In addition to these, reconstructions are made for the purpose of comparing the sinuses of one side, taken together, with those of the other side. This is done by projecting the sinuses of the right side, colored green, over those of the left side colored yellow. As all projections are thus treated, comparisons are possible between the group of sinuses in all diameters, properly controlled by the duplication in the different projections. In addition to this, each sinus is projected over its fellow, each ethmoid group being considered as one, so that it is possible to compare the contour of each sinus with its fellow in three different projections, comprising a duplication of each of the three diameters.

When these drawings are examined, the resemblance of the figures representing the two sides is so great that it is most striking, especially when the variation in the shape of the individual sinuses themselves is considered. For instance, in the lateral projection it is seen that the diameters of the combined sinuses follow one another with remarkable regularity, and when there is any considerable difference there is, as it were, a compensation in another direction. Thus the sphenoid portion of the right side is seen to extend back of the left side but a trifle more than the left extends above the right. The lower borders of the two groups correspond very closely to each other. (Pl. XII.)

A very similar condition of things is to be observed in the anterior projection. There is very little difference in the figures of the two sides except in the sphenoid region, and there the essential difference is in the position of the internal wall of the sphenoid. (Pl. XIII.)

The same thing may be noted in the superior projection, although here the left ethmoid region is somewhat more per-

ipherally placed than the right, the left sphenoid portion is
broader and the right sphenoid portion longer, the total amount
of the overlapping being about the same.   (Pl. XIV.)

DESCRIPTION OF THE SINUSES.

In the description which follows, no attempt is made to com-
pare what is found in the projected head with that found in
any other head or established by any other form of morpho-
logic study.   It is intended only to give an accurate descrip-
tion of what is determined in this head by the projection
made after the manner stated.

In the main, the measurements given are those between par-
allel planes, both because the method of projection fixes the
distances in this way, and because where there is any inclina-
tion in one direction or another, the difference is insignificant
or may be readily computed.   For instance, if the distance
from plane to plane is 40 mm., and the distance in the other
direction is 10 mm., the exact distance according to the well-
known formula, the square of the base plus the square of the
altitude is equal to the square of the hypothenuse, would be

$$\sqrt{1600+100} \text{ or } 41.6 \text{ mm.}$$

If there be a further distance in another direction, the increase
will be corresponding.   However, points have been selected
where these differences are at a minimum.

MAXILLARY SINUS.

LEFT MAXILLARY.   In describing this sinus, no account is
taken of the small canal 6 mm. long and 5 mm. in diameter,
connecting the sinus with the first anterior ethmoid cavity on
the left side.   It appears to be an accidental communication
close to the opening of the maxillary sinus into the hiatus.   (Pl.
VIII.)

The left maxillary sinus extends 33 mm. in a vertical direc-
tion, 27 mm. laterally, 36 mm. antero-posteriorly, and 5 mm.
below the floor of the nose.

The inferior turbinate runs along its inner wall, extending
7 mm. anterior and 10 mm. posterior to the sinus.   The tur-
binate covers the inner wall for a distance of 34 mm. antero-
posteriorly, occupying 13 mm. vertically at its widest portion

(5 mm. behind the orifice of the naso-lachrymal canal), and 7 mm. in its narrowest portion, at its posterior extremity.

The first ethmoid turbinate passes downward and backward over the inner wall of the sinus, the anterior border crosses it 10 mm., and the posterior border 25 mm. from the anterior extremity of the sinus. It extends 8 mm. posterior to the sinus, and its lower border is 14 mm. above the floor.

The antero-inferior border of the second ethmoid turbinate lies internal to, above and behind the sinus, but descends 7 mm. below the level of the superior wall.

The naso-lachrymal canal which runs along its internal wall for a distance of 11 mm. reaches it 4 mm. behind its anterior wall.

The hiatus semilunaris comes into relation with the maxillary sinus only in the uppermost part of the internal wall, where it passes obliquely downward and backward for 12 mm.; however, on account of the concavity in the superior wall of the sinus, there is no cavity through 4 mm. of this distance.

The upper level of the sinus lies 1 mm. below the lowest level of the anterior ethmoid cells and 4 mm. above that of the posterior. The internal wall of the ethmoid cells is 10 mm. nearer the median line than the anterior wall of the maxillary in its upper portion and 14 mm. in its lower. (Pl. IX.)

It does not come into direct relation with the sphenoid, the anterior wall of which is 4 mm. behind its posterior extremity; however, the anterior projection shows that the infero-external extremity of the sphenoid is 18 mm. below the level of the superior wall of the maxillary sinus.

The lower wall of the frontal is 10 mm. above the upper wall of the maxillary, which is surmounted by a small tongue of the frontal 7 mm. by 6 mm. (Pl. XI.)

RIGHT MAXILLARY. The vertical diameter of the right maxillary is 34 mm., the lateral 27 mm., and the antero-posterior 38 mm. Its floor extends 4 mm. below the floor of the nose. (Pl. X.)

The inferior turbinate, whose antero-inferior extremity extends 2 mm. in front of the anterior wall and from 8 to 13 mm. behind the posterior, covers a space on its internal wall 31 mm. long and 12 mm. wide at its widest portion, and 6 mm. at its narrowest.

The first ethmoid turbinate passes downward and backward

over the inner wall, intersecting it 10 mm. and 25 mm. behind its anterior wall, the posterior intersection being 11 mm. in front of its posterior wall. The posterior extremity of the first ethmoid turbinate passes 5 mm. behind the posterior wall of the sinus, whose inferior wall is 16 mm. below the inferior border of the first ethmoid turbinate.

The antero-inferior border of the second ethmoid turbinate just crosses over the postero-superior wall of the sinus, and the posterior border lies above, but almost on a level posterior to the posterior wall of the sinus.

The naso-lachrymal canal reaches the level of the superior wall 4 mm. behind the anterior wall of the sinus, and extends from this place 13 mm. downward.

The hiatus semilunaris extends along the upper wall for a distance of 13 mm., beginning 9 mm. behind its anterior wall and ending 11 mm. in front of its posterior wall.

The anterior ethmoid cells lie above and internal to the maxillary sinus, the posterior likewise, except that posteriorly the internal wall passes internal to their outermost wall to the extent of 1 mm.

This maxillary sinus lies entirely in front of and almost entirely external to the sphenoid, the minimum distance of the planes in the former instance being 2 mm. and the overlapping in the latter being also 2 mm. (Pl. IX.)

The floor of the frontal lies 10 mm. above the roof of the maxillary. The tongue-like projection which overhangs the anterior portion extends laterally 8 mm. and antero-posteriorly 10 mm. (Pl. XI.)

Comparisons. The two maxillary sinuses' correspond very closely to each other, the left being slightly greater in a lateral direction, while the right is longer in an antero-posterior and in a vertical direction, except at the level of the canal leading up to the anterior ethmoid. (Pl. XII, XIII and XIV.)

Sphenoid Sinus.

Left Sphenoid. The floor of the left sphenoid projects 9 mm. above the highest level of the floor of the nose, though the vertical distance from the posterior part of the floor is 15 mm. The vertical distances of its roof from these points are 36 mm. and 42 mm. respectively, making its vertical diameter 27 mm. (Pl. VIII.) Its greatest lateral diameter is 27 mm.

and its antero-posterior diameter is also 26 mm. In its upper portion, it projects to the right of the median line about 8 mm., extending 6 mm. beyond a slightly convex nasal septum. (Pl. III,.6.) A large portion lies above its fellow and slightly anterior to it. (Pl. IX and XI.)

It does not come into relation with any other sinus except a large posterior ethmoid, which borders it anteriorly and externally. (Pl. III, 5, and XI.) It projects 7 mm. anterior to the posterior border of this cell and 14 mm. external to its internal wall.

Its anterior wall is 26 mm. from the most anterior portion of the bulla ethmoidalis and 30 mm. from the plane of the posterior wall of the naso-lachrymal canal. It is 16 mm. from the posterior wall of the infundibulum. Its anterior wall lies 41 mm. behind the anterior extremity of the inferior turbinate, and its superior wall lies 19 mm. above the highest level of the inferior turbinate. Its floor almost reaches the lowest level of the first ethmoid turbinate and is 10 mm. below the lowermost level of the second ethmoid turbinate.

RIGHT SPHENOID. The floor of the right sphenoid sinus lies 9 mm. above the highest level of the floor of the nose and 14 mm. above the posterior portion of the floor. The vertical distance to the roof of the sphenoid from these points are 28 mm. and 33 mm. respectively, making the vertical diameter 19 mm. (Pl. X.) The lateral diameter is 22 mm. and the antero-posterior is 29 mm. In its lower portion it projects beyond the median line to the extent of about 7 mm., extending 4 mm. beyond the nasal septum, bent convexly to the right. (Pl. IV, 4.) It lies below the left sphenoid sinus for most of its extent. (Pl. IX.)

The most posterior of the ethmoid cells surmounts it for an antero-posterior extent of 10 mm. and laterally 11 mm. A second posterior ethmoid cell almost reaches it at its anterior external wall. Its anterior wall is 25 mm. posterior to the most anterior point of the bulla ethmoidalis and 32 mm. from the posterior wall of the naso-lachrymal canal. It is 16 mm. from the posterior wall of the infundibulum. Its anterior wall lies 39 mm. behind the anterior extremity of the inferior turbinate and its superior wall lies 12 mm. above the highest level of this turbinate. Its floor is a shade lower than the lower border of the first ethmoid turbinate and 10 mm. below the lowest level

of the second ethmoid turbinate, and its anterior wall is 2 mm. behind the posterior border of the second ethmoid turbinate.

Comparisons. The two sphenoids show a marked difference from each other, the left extending 9 mm. above, 2 mm. below, and 4 mm. to the side of the right sphenoid, while the right extends 8 mm. behind the left. (Pl. XII, XIII and XIV.)

Frontal Sinus.

The frontal reaches the highest level of any of the sinuses. The projections show the possibility of the correctness of the view that the frontal sinuses are simply diverticula of the ethmoid which have been interposed upward between the laminae of the frontal bone.

Left Frontal. The frontal is the most anterior of all the cells on the left side, although the maxillary reaches almost the same plane. Its greatest dimensions are, vertically 30 mm., laterally 20 mm. and antero-posteriorly 21 mm.; 9 mm. from its roof, its anterior wall is at the maximum distance from its extreme posterior wall. At 13 mm. this is reduced to 14 mm.; at 17 mm. it is increased to 15 mm., and at 25 mm. it is only 6 mm. This is due to the recession of the anterior wall which is replaced by an ethmoid cell projected upward to within 11 mm. of the roof of the frontal. (Pl. II, 4 and Pl. VIII.)

The highest point of its roof is 67 mm. above the anterior part of the floor of the nose, 55 mm. above the anterior extremity of the inferior turbinate, 50 mm. above its highest level, 46 mm. above the lowest level of the anterior border of the first ethmoid turbinate, 40 mm. above the junction point of the first ethmoid turbinate with the maxillary sinus anteriorly, 33 mm. above the upper surface of the bulla ethmoidalis. The floor of the cavity is 30 mm. nearer these points.

It descends to 1 mm. above the plane of the roof of the sphenoid sinus, and its most posterior point is 16 mm. in front of the anterior wall of the sphenoid.

Its outer wall lies directly above the supero-internal angle of the maxillary which lies 10 mm. below its inferior wall. (Pl. IX.)

Its relation to the ethmoid cells is well shown. Its upper portion lies above the most anterior ethmoid cell, while its posterior portion, which is vertical, lies between this and the large ethmoid cell immediately behind it. It reaches the infundi-

bulum in this space. It thus has the appearance of an ethmoid cell lying between the two others, but reaching a point 11 mm. higher than the one and 21 mm. higher than the other, and extending laterally almost twice and antero-posteriorly one and one-half times as far as either of these cells. The anterior wall of the first posterior ethmoid cell lies 1 mm. behind its posterior extremity, and that of the most posterior ethmoid cell, 11 mm. (Pl. VIII.)

RIGHT FRONTAL. The frontal is the most anterior of all the sinuses on the right side, being 5 mm. anterior to the ethmoid and 2 mm. to the maxillary. Its greatest diameters are vertically 30 mm., laterally 24 mm., and antero-posteriorly 22 mm. Its anterior wall passes quite uniformly downwards and backwards, while the posterior wall, after passing almost parallel to this for three-fourths of its distance, turns sharply backwards. As a consequence, the maximal antero-posterior diameter is at the lower part of the sinus, while the minimal is at the roof. (Pl. X.)

The roof is 68 mm. from the anterior part of the floor of the nose, 59 mm. from the anterior extremity of the inferior turbinate, 52 mm. from its highest level, 47 mm. above the inferior level of the anterior end of the first ethmoid turbinate, 42 mm. from the intersection of the first ethmoid turbinate with the maxillary, 34 mm. from the highest level of the bulla ethmoidalis. The floor is 30 mm. nearer these points.

It is 10 mm. above the roof of the sphenoid, the anterior wall of which is located 21 mm. behind its posterior wall. Its outer wall lies directly above a small portion of the maxillary sinus to the extent of 10 mm. laterally.

It is superimposed immediately above the anterior ethmoid group of cells and is in contact with the two upper cells of this group. One of these cells extends 2 mm. behind the posterior wall, and while the other extends anterior to the lower portion of the anterior wall, it is overhung by the upper portion.

The most posterior of the ethmoid cells lies 2 mm. behind its posterior wall.

Comparisons. The right frontal is much larger than the left frontal, the anterior wall of the latter being replaced by the ascending anterior ethmoidal cell. These two taken together about equal the right frontal in size and shape. There is very little difference in the vertical diameter of the two

sinuses, but the right extends a considerable distance more externally and a small distance more anteriorly. (Pl. XII, XIII and XIV.)

ETHMOID CELLS

LEFT ETHMOID. The left ethmoid labyrinth lies below the frontal, above and internal to the maxillary, and in front of the sphenoid. On the left side, the greatest vertical diameter is 34 mm., the antero-posterior 42 mm., and the lateral 12 mm.

The anterior group is composed of two large cells, the first running downwards and backwards, the other downwards and forwards. The infundibulum lies inward between these, although the inner wall of the first ethmoid is on the same level internally. The bulla ethmoidalis is constituted by the inner and the infero-anterior wall of the second cell. The first cell extends 11 mm. higher than the second, and the latter 5 mm. lower than the former.

The following show the distances from the highest levels of the two cells taken together: Floor of the nose, anterior level, 56 mm., anterior end of the inferior turbinate 44 mm., highest level of inferior turbinate 39 mm., lowest level of the anterior border of the first ethmoid turbinate 35 mm., intersection of the first ethmoid turbinate with the wall of the maxillary sinus 27 mm., upper border of the bulla ethmoidalis 22 mm. At the level of the upper border of the bulla ethmoidalis, which lies at the posterior wall of the first cell, the first cell extends 8 mm. anterior and the second 12 mm. posterior. The second cell overlaps the first posterior ethmoid cell antero-posteriorly almost the entire distance. The posterior wall of this cell lies 8 mm. anterior to the anterior wall of the sphenoid sinus. (Pl. VIII.)

The posterior group of cells consist of three cells, two of which are large, constituting the superior, posterior, and anterior, and a much smaller one lying inferiorly. They encroach 7 mm. upon the sphenoid and 7 mm. upon anterior ethmoid, antero-posteriorly.

RIGHT ETHMOID. The right ethmoid labyrinth comprises ten distinct cells, of which four belong to the anterior group and six to the posterior. The greatest vertical diameter is 28 mm., its lateral 12 mm., its antero-posterior 47 mm. The dimensions of the anterior group, considered from the stand-

point of the greatest diameters, are vertically 20 mm., laterally 7 mm., and antero-posteriorly 29 mm.   The corresponding dimensions of the posterior group are 25 mm., 12 mm., and 29 mm.

The infundibulum lies internal to the anterior group of cells and anterior to the posterior group. The bulla ethmoidalis is formed by the anterior wall of the two lower anterior ethmoid cells. The most anterior ethmoid cells lies just below the frontal and internal to the naso-lachrymal duct, above the level of which most of it is situated. The second cell, which is behind the first cell, lies below the frontal and extends somewhat posterior to it. Below this cell are to be found the two cells whose anterior walls constitute the bulla ethmoidalis. The first of these is only half the length, antero-posteriorly, of the second cell, placed immediately below. The last cell is the only one of the anterior ethmoid cells which projects into the region of the posterior ethmoid, the overlapping antero-posteriorly being 10 mm. and vertically 9 mm. The following show the distances from the highest level of the cells of the anterior group: Floor of the nose, anterior level, 48 mm., anterior end of the inferior turbinate 39 mm., upper level of the inferior turbinate 32 mm., lowest level of the anterior border of the first ethmoid turbinate 26 mm., intersection of the first ethmoid turbinate with the wall of the maxillary sinus 22 mm., upper border of the bulla ethmoidalis 14 mm. The first cell extends 12 mm. anterior and 2 mm. posterior to the antero-superior border of the bulla ethmoidalis. The floor of the second cell is 5 mm. above it, and extends 7 mm. behind it. As already stated, the wall of the bulla is a portion of the anterior wall of the two other anterior ethmoid cells. As the upper part of the bulla is 8 mm. above the intersection of the first ethmoid turbinate and the maxillary sinus, 25 mm. above the anterior end of the inferior turbinate, and 34 mm. above the floor of the nose, the distances of these structures from the floor of the four cells can be readily ascertained. The bulla is 13 mm. behind the anterior end of the inferior turbinate.   (Pl. X.)

The posterior group of cells may be considered as a cavity with numerous septa dividing it into smaller cells, occupying the lateral mass of the ethmoid bone behind the anterior ethmoid cells. They lie above and in front of the sphenoid and

above, behind and to the inner side of the maxillary. The most posterior cell overlaps the sphenoid to the extent of 10 mm., being directly in relation laterally and posteriorly with the sphenoid on the other side. Below this is a narrow cell which approaches the maxillary and follows it for a distance of 15 mm.

Comparisons. The left anterior ethmoid cells appear to be very much more extensive than the right, by reason of the very large ascending anterior ethmoid cell. It is by reason of this that the left anterior ethmoid group of cells reaches a level 6 mm. above that of the right, and extends 4 mm. in front.

The right posterior ethmoid cells are manifestly much larger than the left and appear so in every diameter except the vertical. They lie 3 mm. more internal than those of the left side. (Pl. XII, XIII and XIV.)

ORIFICES OF THE SINUS.

In addition to the reconstructions already described, two others have been made, showing the different orifices in their relation to the turbinates, naso-lachrymal canal and other structures. (Pl. XV and XVI.)

The most conspicuous figures in these drawings are those of the infundibulum, hiatus semilunaris and the fossa behind the bulla. The bulla projects, as it were, between the infundibulum above, the infundibulum and hiatus in front, and this fossa behind.

The left infundibulum is 10 mm. in an antero-posterior direction and 5 mm. in a lateral direction. Its anterior half is continued downwards and backwards, by a cleft between the uncinate process and bulla, for a distance of 14 mm. Its posterior half opens into a fossa 6 mm. deep, which passes almost directly downwards.

The right infundibulum is 12 mm. antero-posteriorly and 6 mm. laterally; its anterior half is continued downward, and then backwards, more horizontally than on the other side, for a distance of 20 mm. Its posterior half opens into a fossa corresponding to that on the opposite side, running almost directly downwards for 6 mm.

On the left side, the infundibulum receives the orifice of the frontal through its roof, and of the maxillary in its extension,

just where it changes its direction from downward to down-
ward and backward. The fossa behind the bulla receives the
opening of the second anterior ethmoid cell at its lowest
portion. The first anterior ethmoid cell, as has already been
stated, opens into the maxillary. The three posterior ethmoid
cells open into the superior meatus, two anterior to the anterior
border of the second ethmoid turbinate, and two behind it. (The
most anterior cell of this group has two openings, one anterior,
the other posterior to the border.) The orifice of the sphenoid
is entirely behind the second ethmoid turbinate.

The orifices of the maxillary sinus, the second anterior eth-
moid, the small posterior ethmoid lying just above the maxil-
lary, and the sphenoid are on a line but slightly inclined from
the horizontal, the difference in level between the first and last
of these being 5 mm. The opening of the most posterior eth-
moid is 3 mm. below this, of the other posterior ethmoid
1 mm. above, and of the frontal 8 mm. above. The orifice of
the maxillary sinus is 31 mm. above the highest level of the
floor of the nose, 19 mm. above the level of the anterior ex-
tremity of the inferior turbinate, and 11 mm. above the lowest
level of the anterior border of the first ethmoid turbinate. The
orifices lie the following distances behind the anterior border
of the first ethmoid turbinate; frontal 5 mm. maxillary 3 mm.,
second anterior ethmoid 8 mm., posterior ethmoid 13 mm.,
17 mm., 19 mm., and 28 mm., respectively, and the sphenoid
29 mm. The naso-lachrymal canal is 3 mm. farther away. The
distances from the anterior extremity of the inferior turbinate
are as follows: frontal 19 mm., maxillary 17 mm., second an-
terior ethmoid 22 mm., posterior ethmoid 27 mm., 31 mm.,
33 mm., and 41 mm., respectively, and the sphenoid 43 mm.
The distances from the floor of the cranial fossa at the cor-
responding levels are as follows: frontal 13 mm., maxillary
23 mm., second anterior ethmoid 19 mm., posterior ethmoid
12 mm., 17 mm., 12 mm. and 16 mm., respectively, and the
sphenoid 14 mm.

On the right side, the frontal opens on the roof of the
infundibulum, the maxillary in the horizontal portion; the
two upper anterior ethmoid cells open also into the infundi-
bulum, as well as the cell constituting the upper portion of
the bulla ethmoidalis. The cell constituting the lower portion
opens into the fossa which extends downward from the infundi-

bulum. The six posterior ethmoid cells open into the superior meatus, all but one being above the antero-inferior border of the superior turbinate. The sphenoid opens 7 mm. behind the posterior border of the second ethmoid turbinate.

The distances of the orifices from the highest level of the floor of the nose are as follows: frontal 31 mm., anterior ethmoid 35 mm., 38 mm. (two) and 32 mm., respectively; posterior ethmoid 29 mm., 27 mm. (three), 33 mm., 26 mm., respectively. maxillary 27 mm., sphenoid 25 mm. The distances above the level of the anterior extremity of the inferior turbinate are: frontal 30 mm., anterior ethmoid 26 mm., 29 mm. (two), 23 mm., respectively; posterior ethmoid 20 mm., 18 mm. (three), 24 mm., and 17 mm., respectively; maxillary 18 mm., and sphenoid 16 mm. Above the lowest level of the anterior border of the first ethmoid turbinate, the distances are: frontal 16 mm., anterior ethmoid 12 mm., 15 mm. (two), and 9 mm., respectively; posterior ethmoid 6 mm., 4 mm. (three), 10 mm., and 3 mm., respectively; maxillary 4 mm., sphenoid 2 mm. The orifices lie the following distances behind the anterior border of the first ethmoid turbinate; frontal 3 mm., anterior ethmoid 3 mm., 8 mm., 9 mm., and 10 mm. respectively; posterior ethmoid 15 mm., 19 mm., 21 mm. (two) 25 mm., and 28 mm., respectively; maxillary 8 mm., and sphenoid 35 mm. The naso-lachrymal canal is 1 mm. farther away. The distances from the anterior extremity of the inferior turbinate are 7 mm. greater.

CONCLUSIONS.

The method of study here presented and carried out in detail on the head described, gives an accurate picture of the different diameters of the sinuses shown by reconstructions, anteriorly, superiorly and laterally. It is possible through this to obtain the distances of the sinuses from more or less fixed and accessible structures in or about the nose.

The error is reduced to a minimum, being no greater than that which follows from the grossness of all macroscopic measurements in connection with the human body. All measurements are thus subject to an error of 1 millimeter, far less than can not be noted by the eye except under the most favorable circumstances.

While the method deals particularly with the greatest diame-

ters of the sinuses, it may be utilized to reconstruct any por-
tion of an organ large or small. In this way, a study may be
made of special details, without reference to the complete re-
constructions. By no other method can comparisons in the
shape or position of the sinuses be so accurately made. For
here we have any plane or the composite plane fixed in such
a manner that comparisons may be made by superimposing
one projection upon the other. It is just as easy to recon-
struct one wall of a sinus as all the walls, hence, one may
choose his own problem in this connection.

The preparations from which these reconstructions are
made, are not destroyed, but preserved, so they may be used
for control, study and comparisons for other methods as well
as this.

A series of heads reconstructed in the manner indicated
will certainly give valuable information as to the character of
the variations of the sinuses, and their relations with one an-
other and other structures. It will be easy, when a sufficient
number of heads have been reconstructed, to draw a compo-
site of the sinuses, showing their average shape, position and
relations.

Grateful acknowledgment is made to Dr. Peter Potter,
for his cordial advice and assistance in the beginning of this
work, and to Miss Alice Ethel Hamilton, who has so faithfully
executed the drawings and assisted in the reconstructions.

DESCRIPTION OF PLATES.

Plate 1.—1. Right frontal sinus; 2. Left frontal sinus; 3. Roof of orbit; 4. Superior longitudinal sinus; 5. Falx cerebri; 6. Fissure of Sylvius; 7. Island of Reil; 8. Frontal operculum; 9. Anterior horn of lateral ventricle; 10. Posterior horn of lateral venticle; 11. Optic thalamus.

Plate II.—1. Right frontal sinus; 2. Anterior ethmoid cell; 3. Left frontal sinus; 4. Anterior ethmoid cells displacing anterior wall of the frontal sinus; 5. Crista galli; 6. Fissure of Sylvius; 7. Eye muscles; 8. Lachrymal gland; 9. Superior longitudinal sinus; 10. Lateral ventricle; 11. Third ventricle; 12. Pineal gland; 13. Aqueduct of Sylvius; 14. Opening into pituitary body and foramina of Munro.

Plate III.—1. Naso-lachrymal canal; 2. Infundibulum; 3. Anterior ethmoid cells; 4. Anterior ethmoid cell which replaces anterior wall of the frontal sinus; 5. Posterior ethmoid cells; 6. Left sphenoid sinus lying above the right; 7. Optic nerve; 8. Descending horn of lateral ventricle; 9. Pons; 10. Cerebellum; 11. Superior longitudinal sinus.

Plate IV.—1. Naso-lachrymal canal; 2. First ethmoid turbinate; 3. Maxillary sinus; 4. Sphenoid sinus; 5. Fifth nerve and Gasserian ganglion; 6. Temporo-sphenoidal lobe; 7. Cerebellum; 8. Lateral sinus; 9. Fourth ventricle; 10. Pons; 11. Internal carotid artery.

Plate V.—1. Maxillary sinus; 2. Nasal septum; 3. Inferior turbinate; 4. Temporomaxillary articulation; 5. External auditory canal; 6. Mastoid cells; 7. Lateral sinus; 8. Middle ear; 9. Internal carotid; 10. Semicircular canals; 11. Cerebellum; 12. Medulla; 13. Eustachian tube; 14. Fourth ventricle; 15. Basilar artery.

Plate VI.—1. Pharynx; 2. Maxillary sinus; 3. Roots of teeth; 4. Parotid gland; 5. Mastoid cells; 6. Lateral sinus; 7. Jugular; 8. Internal carotid; 9. Cerebellum; 10. Medulla.

Plate VII.—The sinuses with their orifices, the infundibulum, the cranial cavity, turbinate, naso-lachrymal canal and floor of the nose of the left side are shown as they are reconstructed on millimeter paper, the sinuses and infundibulum being represented by solid lines and the other structures by broken lines.

Plate VIII.—Left lateral reconstruction. In this and Plates IX, X and XI the frontal sinus is colored yellow, the maxillary purple, the sphenoid green and the ethmoid red, the anterior group being lined horizontally and the posterior group perpendicularly. The ethmoid cells are to be noted in two groups, the anterior, three in number, and the posterior, two. The first anterior cell is shown displacing the anterior wall of the frontal and opening into the maxillary sinus. The frontal is seen opening into the infundibulum. The antero-inferior wall of the second ethmoid cell constitutes the bulla ethmoidalis (posterior boundary of the infundibulum).

Plate IX.—Anterior reconstruction. On account of the multiplicity of lines, the individual ethmoid cells are not shown; however, the two groups are represented, the anterior being lined horizontally and the posterior perpendicularly. The left sphenoid sinus lies far above the right; its inner wall extends almost as far to the right as the outer wall of the right sphenoid sinus.

Plate X.—Right lateral reconstruction. The frontal sinus is seen opening into the infundibulum, its inferior wall only being encroached upon by the ethmoid cells. There are four cells belonging to the anterior group of ethmoid cells and five to the posterior. The bulla ethmoidalis is formed by the anterior wall of the two most posterior anterior ethmoid cells.

Plate XI.—Superior reconstruction. The right sphenoid sinus extends almost as far to the left as the left does to the right, while the right lies much more posterior and the left much more anterior. The difference between the right and the left ethmoid cells is well shown.

Plate XII.—Lateral reconstruction: in this and Plates XIII and XIV the sinuses of the right side are colored green and the left yellow. F, frontal; A. E., anterior ethmoid; P. E., posterior ethmoid; S., sphenoid; M., maxillary.

Plate XIII.—Anterior reconstruction; F., frontal; A. E., anterior ethmoid; P. E., posterior ethmoid; S., sphenoid; M., maxillary.

Plate XIV.—Superior reconstruction; F., frontal; A. E., anterior ethmoid; P. E., posterior ethmoid; S., sphenoid; M., maxillary.

XV.—Left lateral reconstruction showing the orifices of the sinuses in relation to the turbinates, infundibulum, cranial cavity and naso-lachrymal canal.

XVI.—Right lateral reconstruction showing orifices of the sinuses in relation to the turbinates, infundibulum, cranial cavity and naso-lachrymal canal.
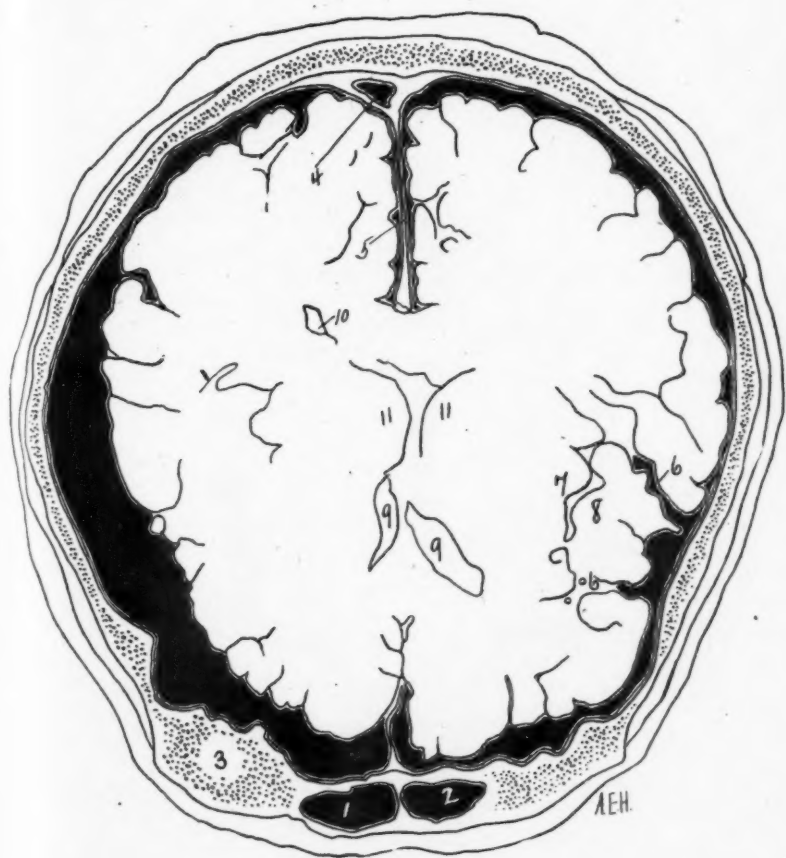
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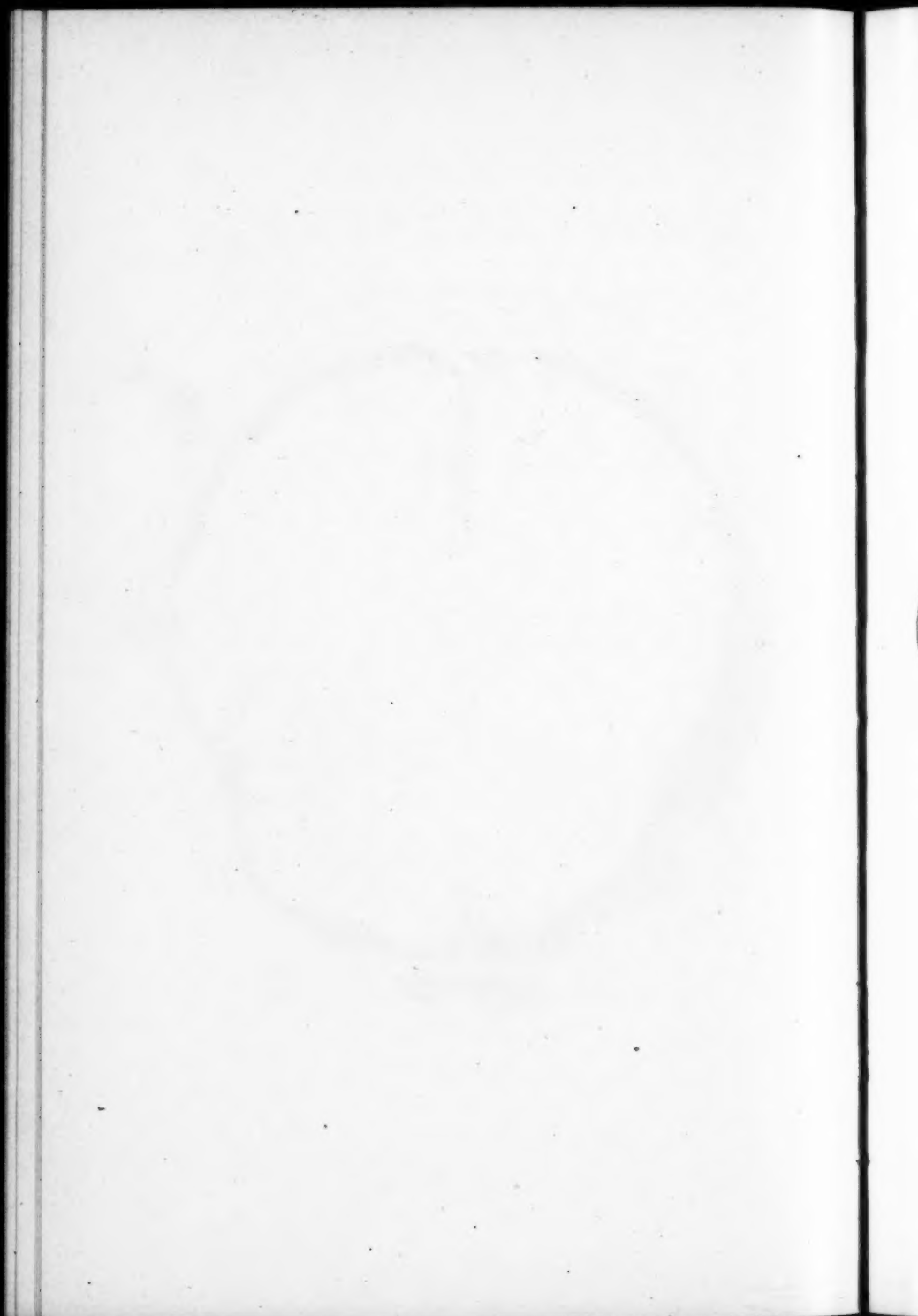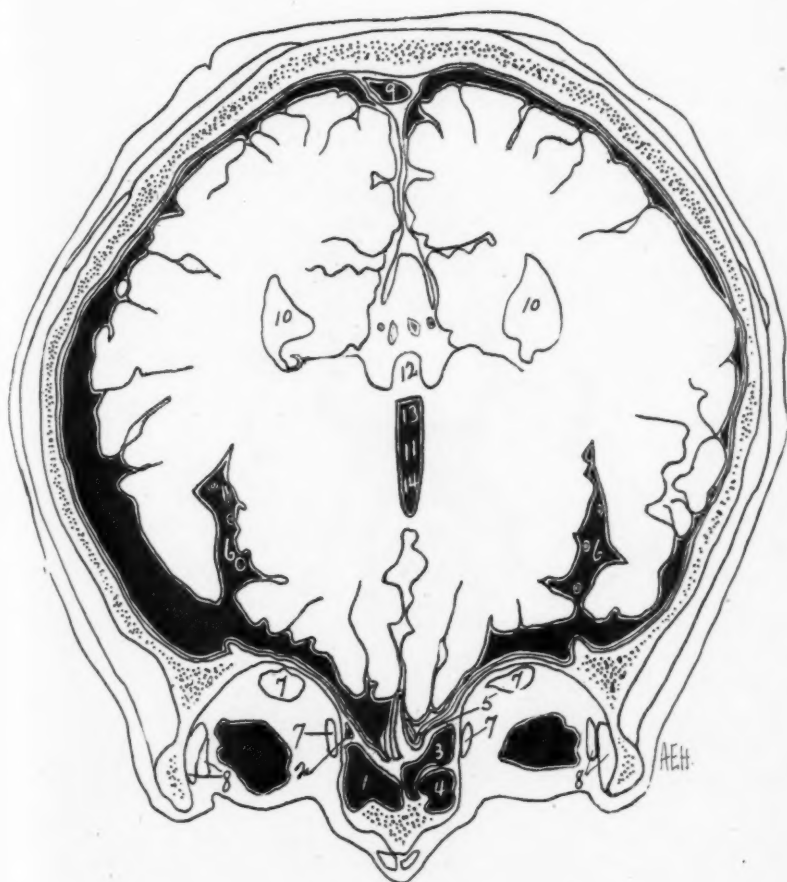
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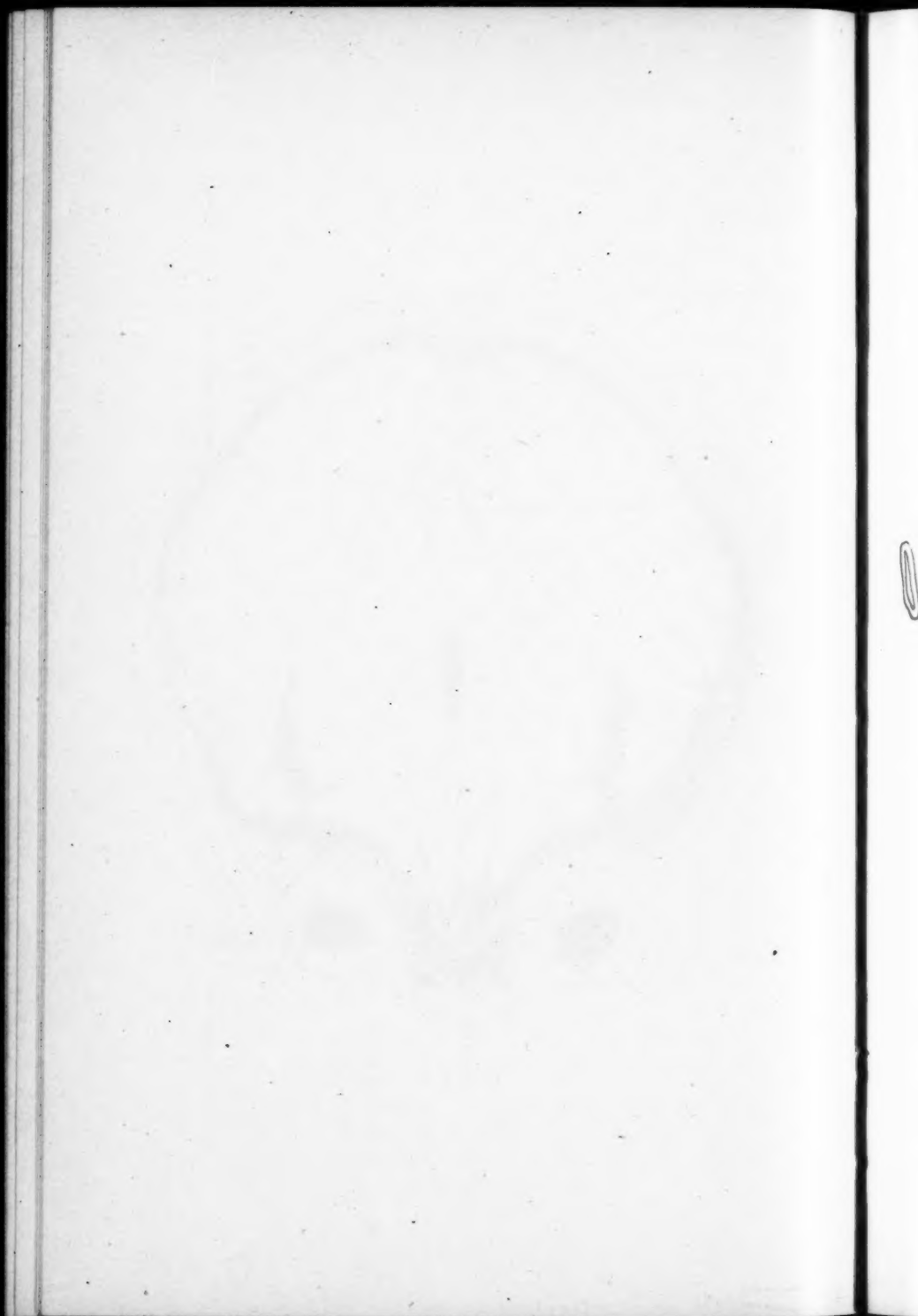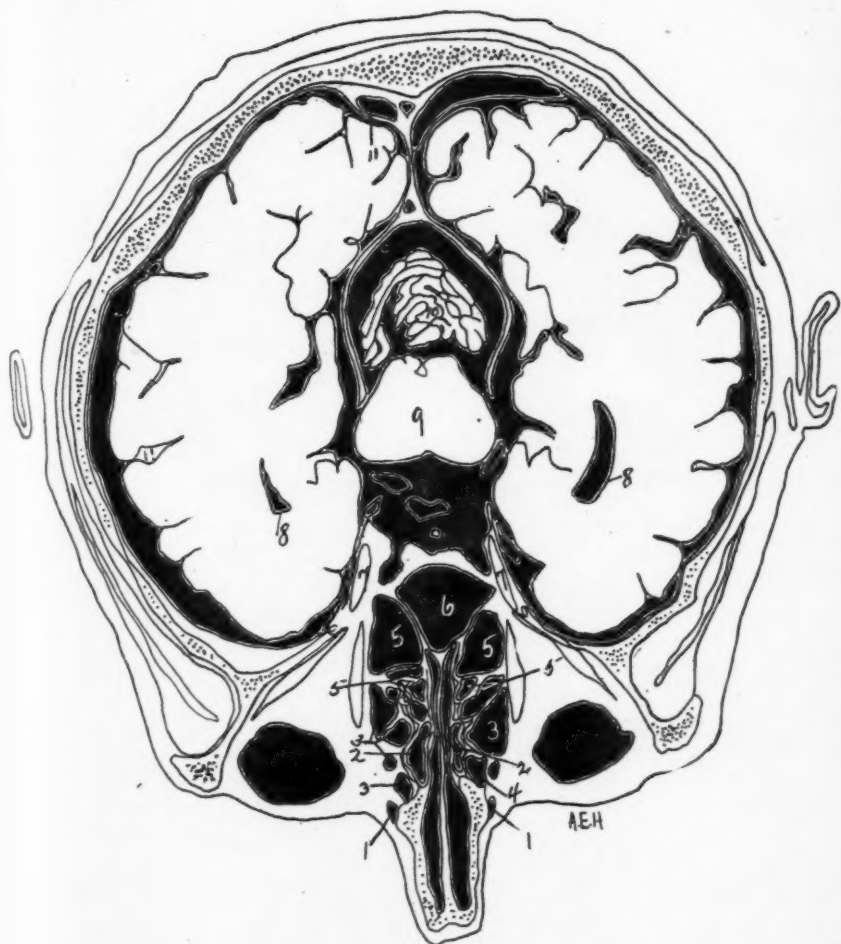
PLATE III.

PLATE IV.

PLATE V.

PLATE VI.
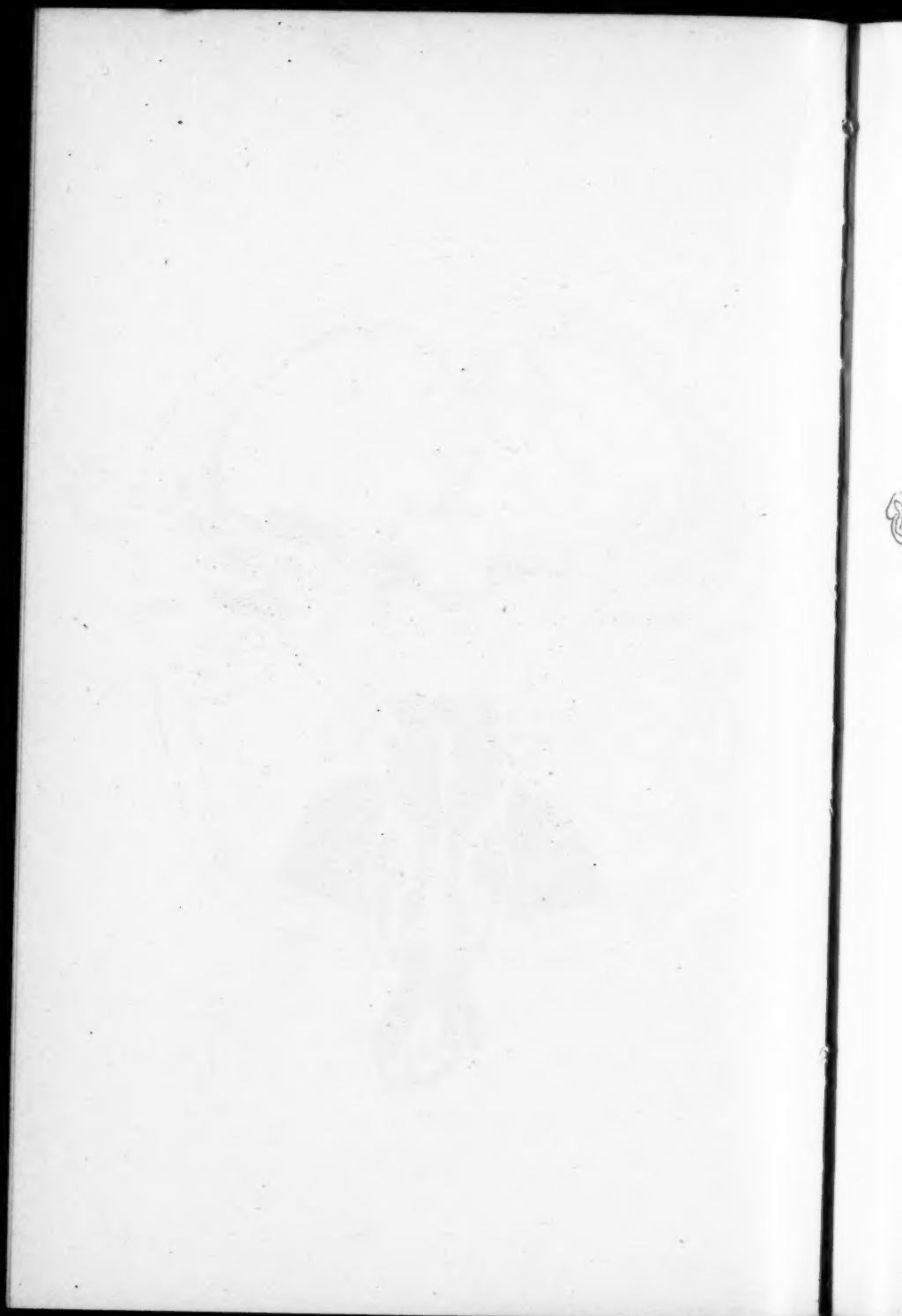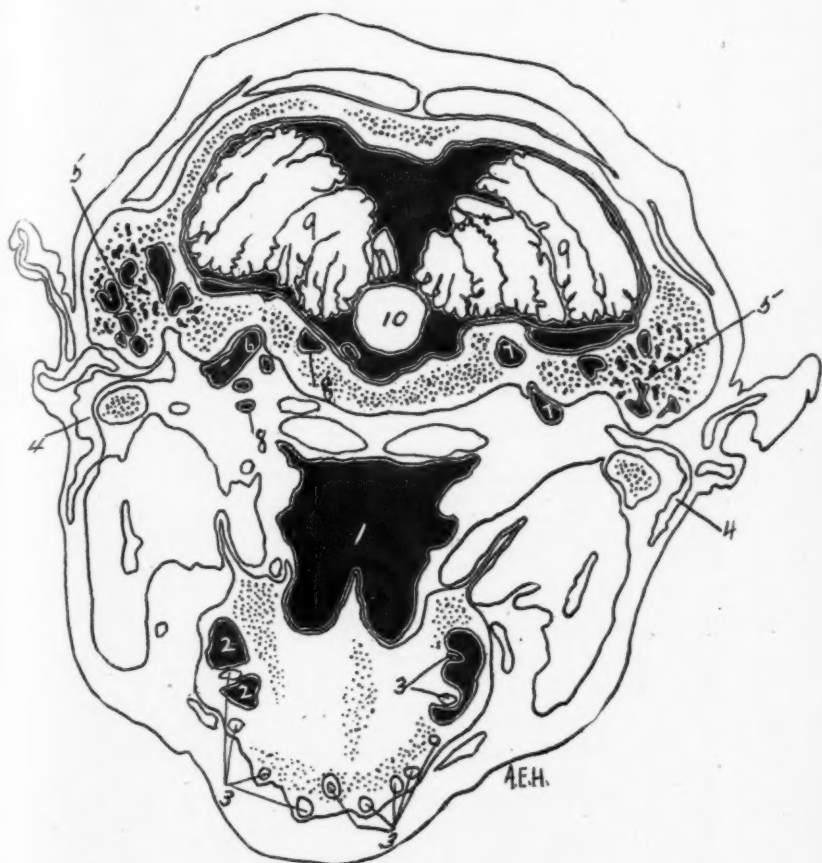
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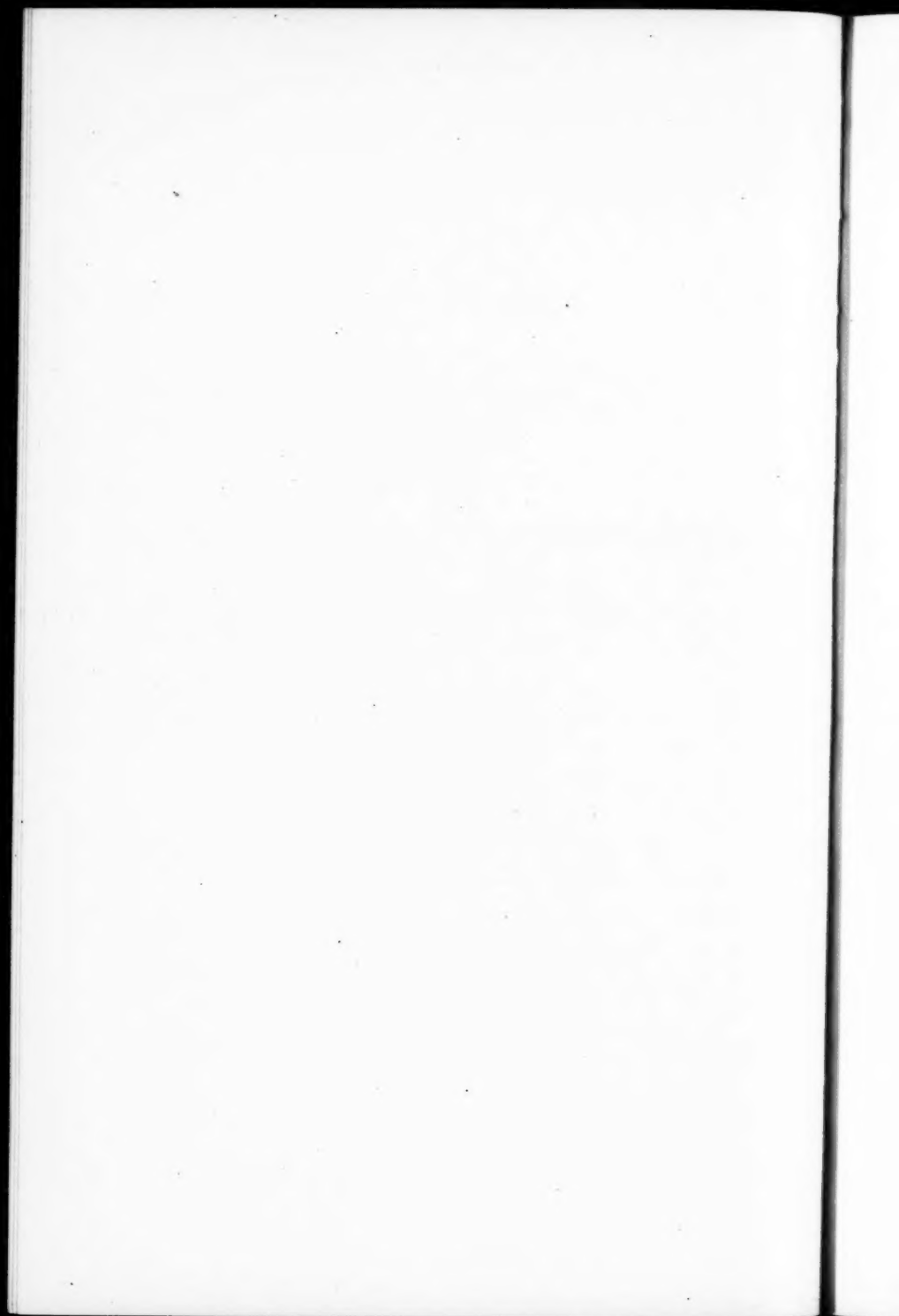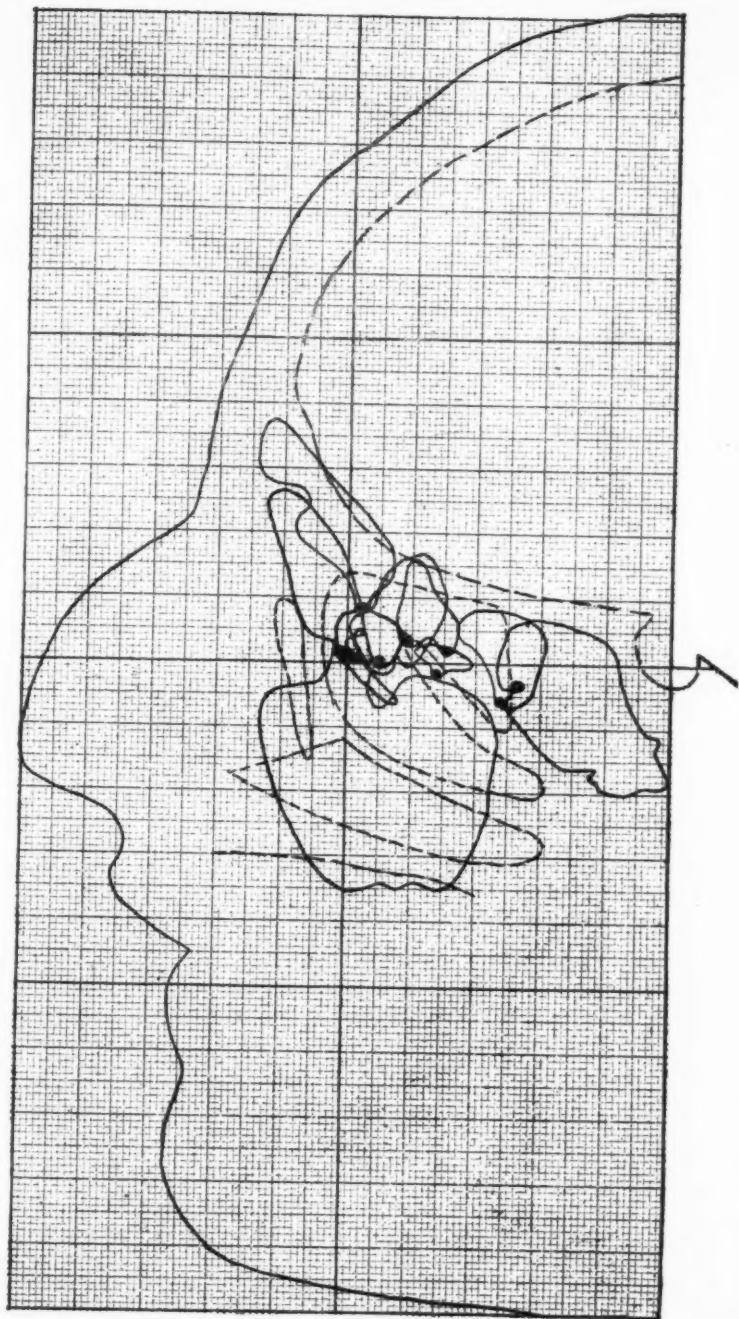
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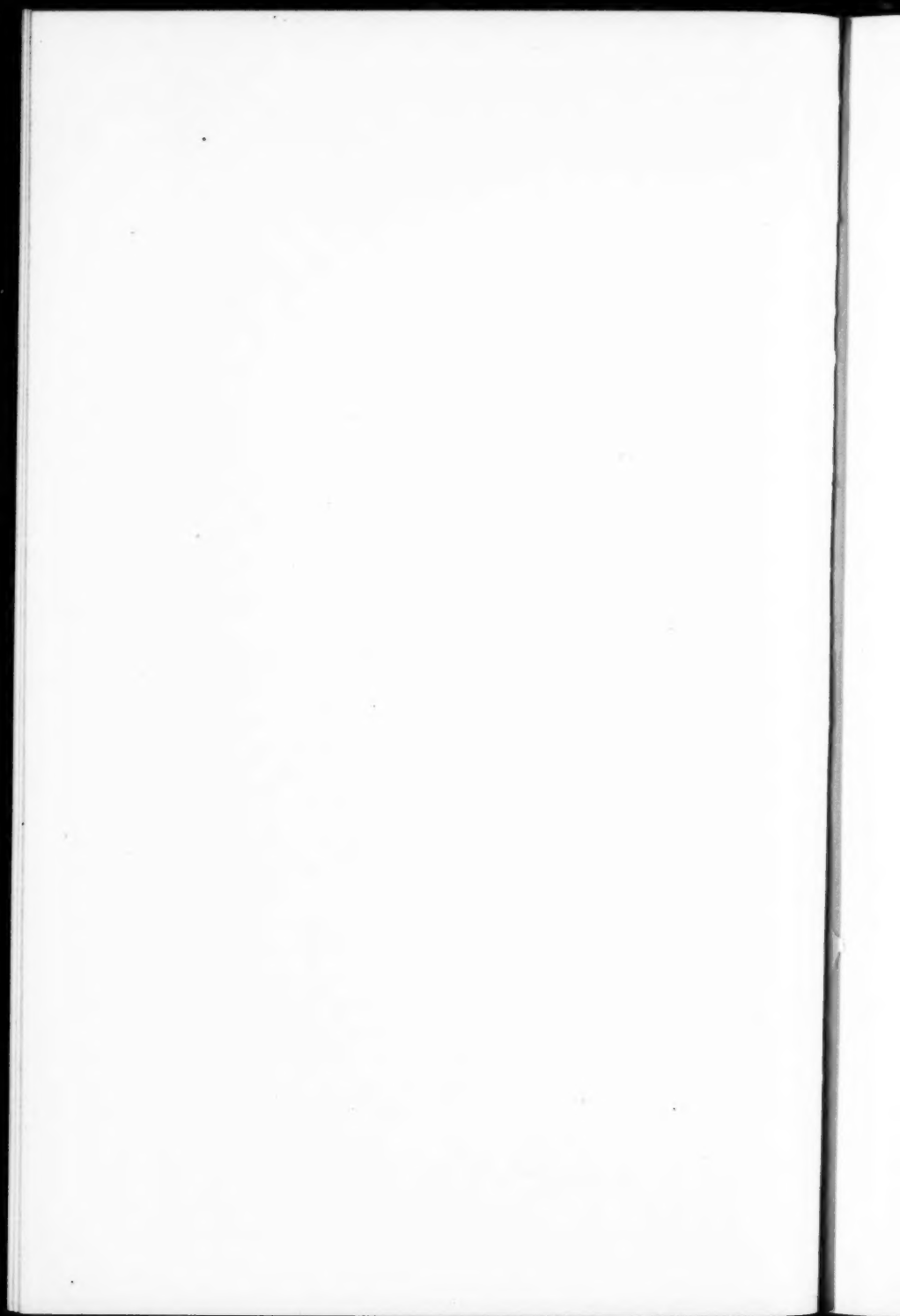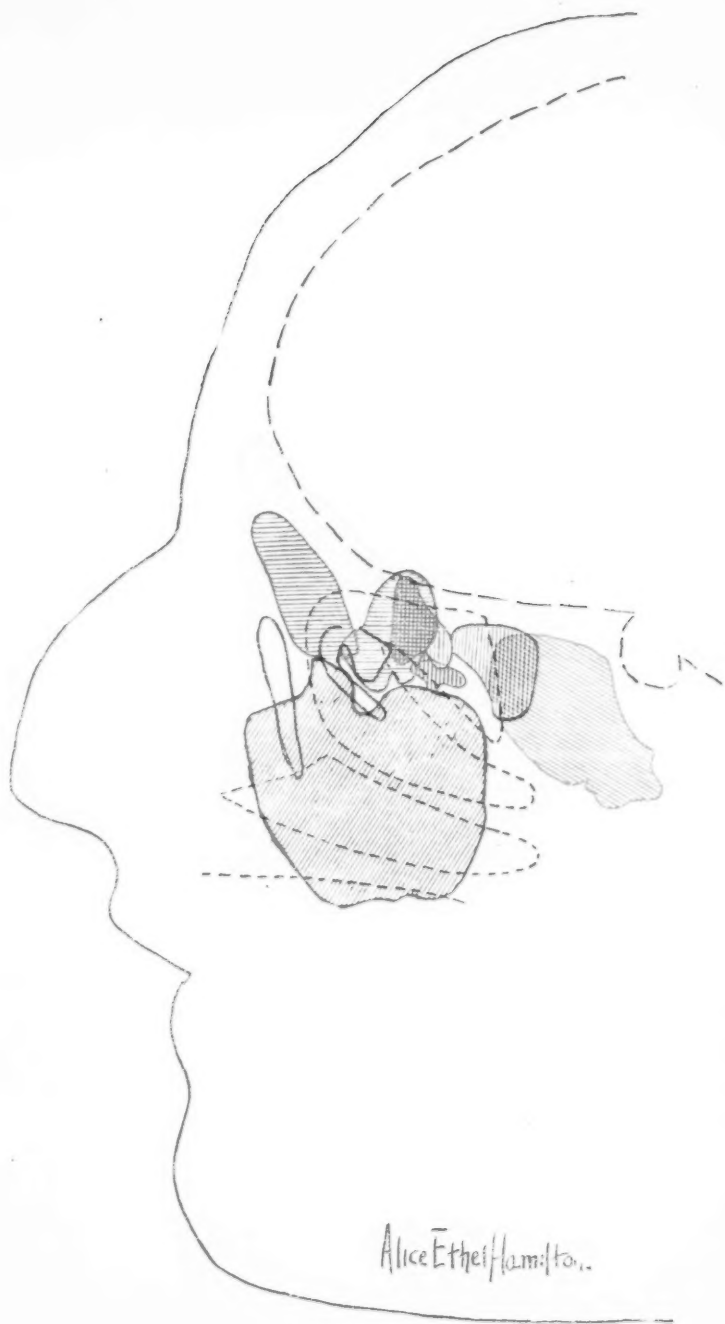
PLATE VIII.

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PLATE IX
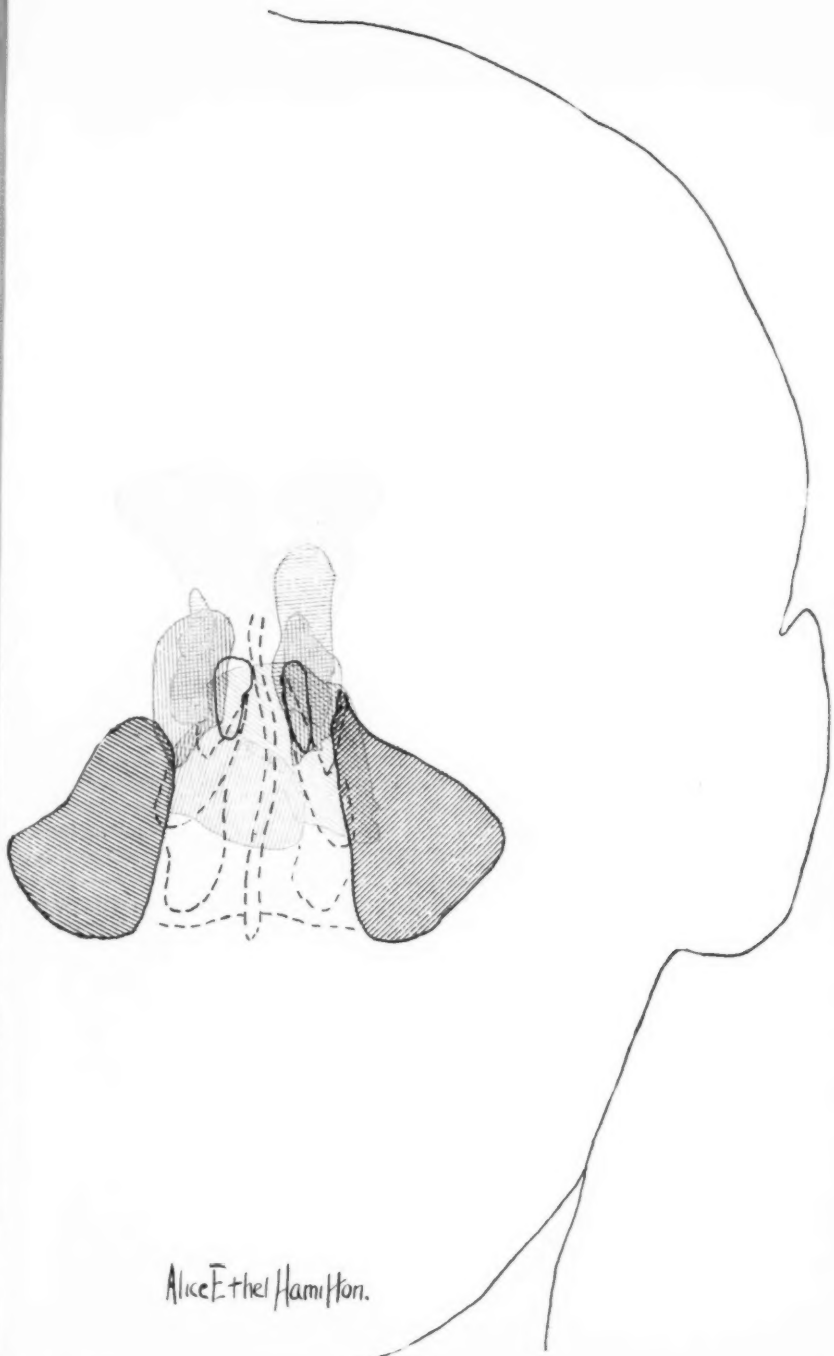
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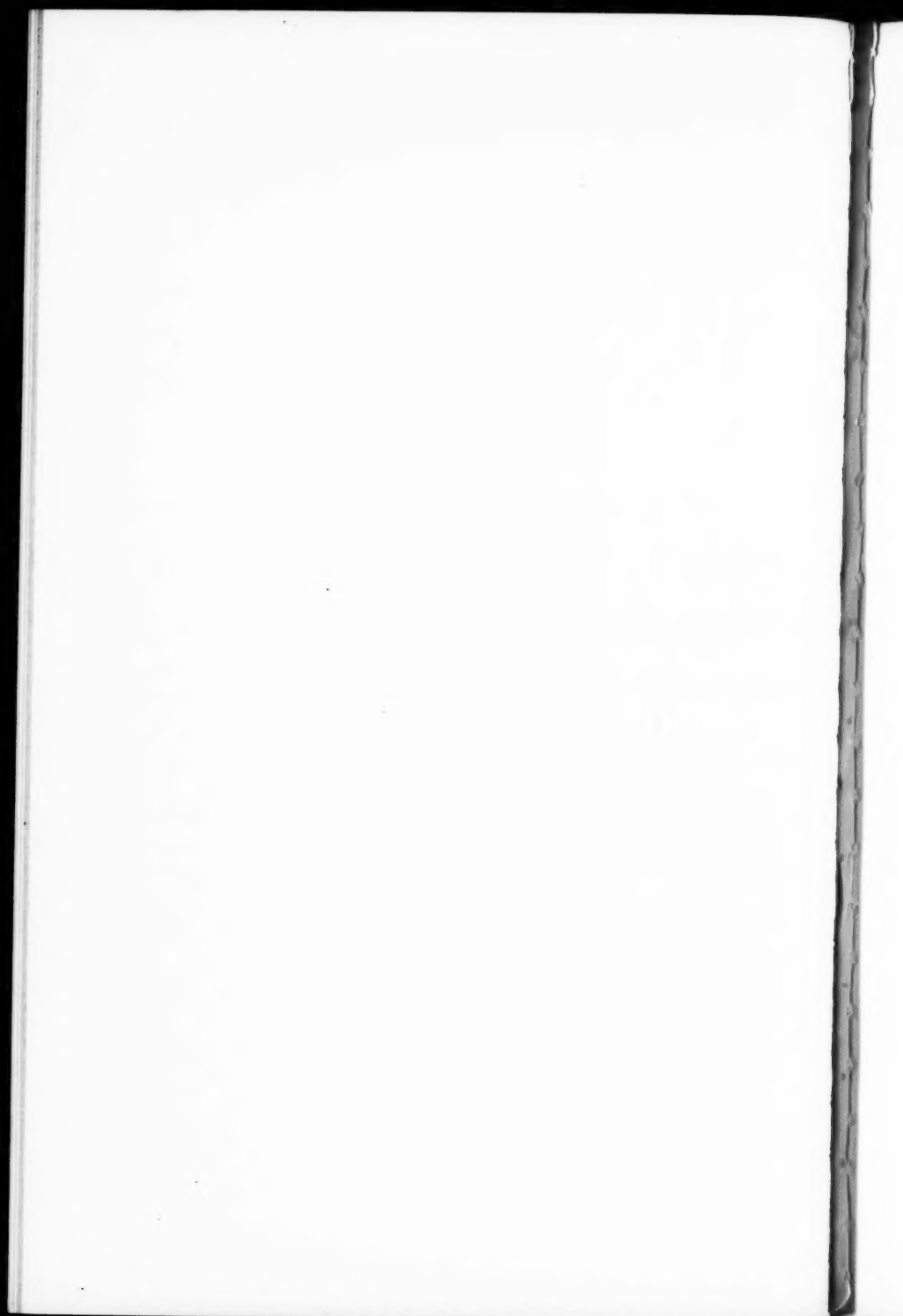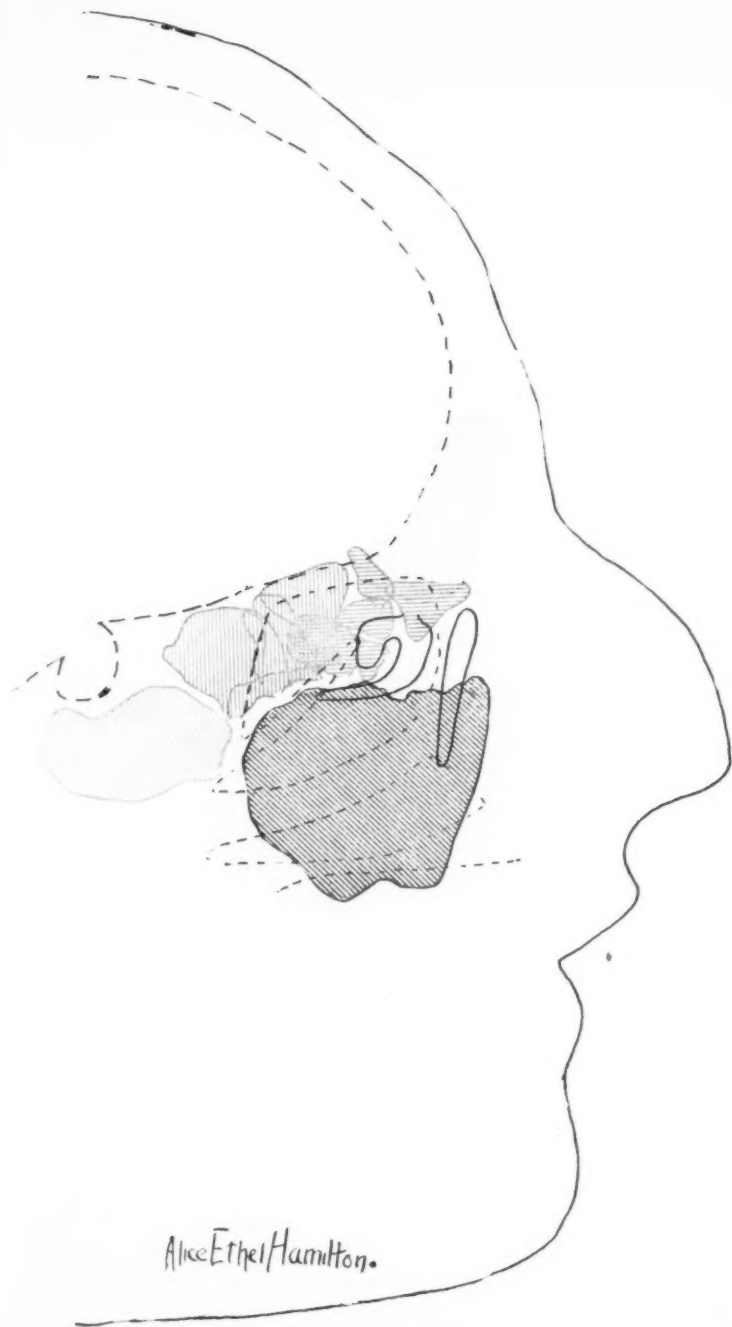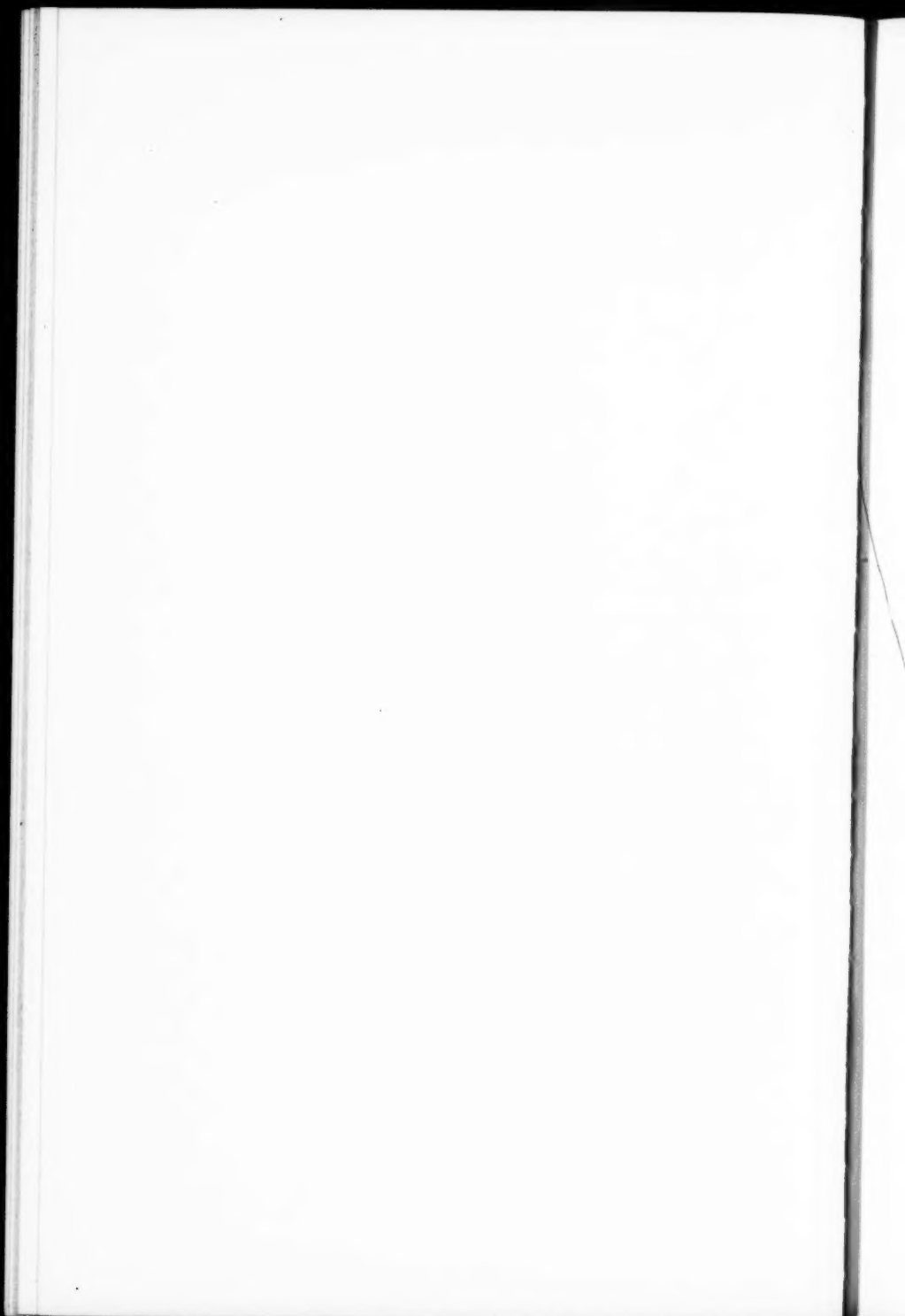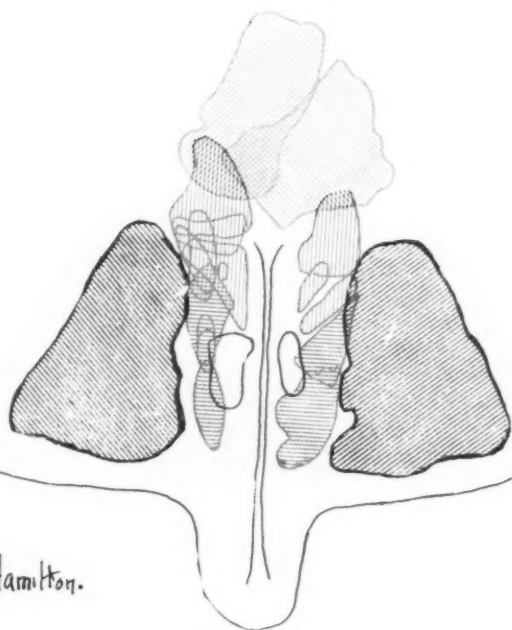
PLATE X.

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PLATE XI.

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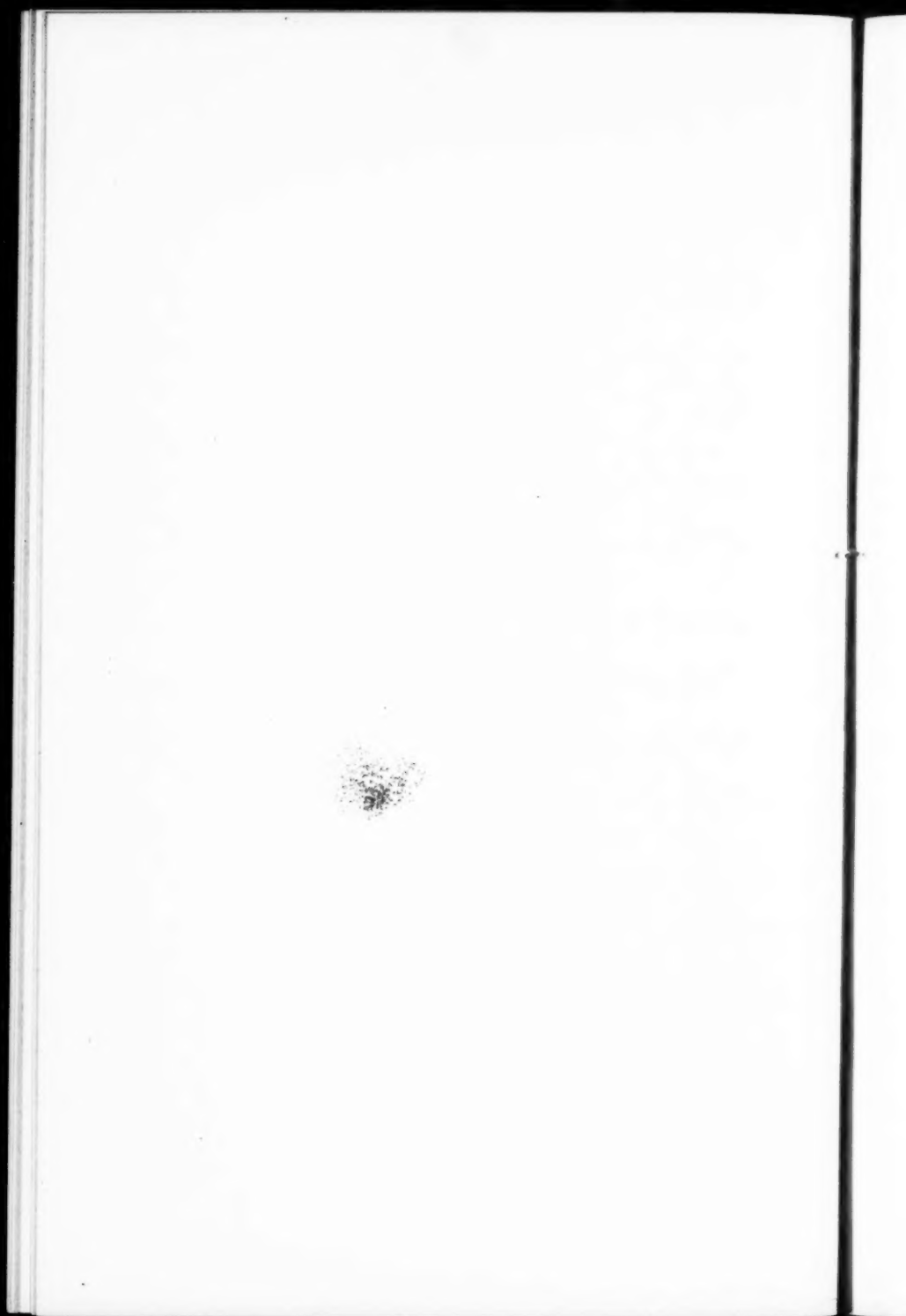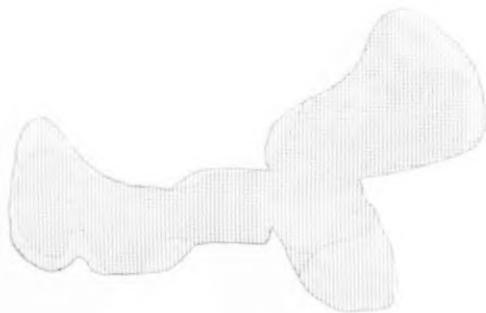
PLATE XII.

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PLATE XIII.

A.E.

F.E.

F.

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PLATE XIV.

E.

M.
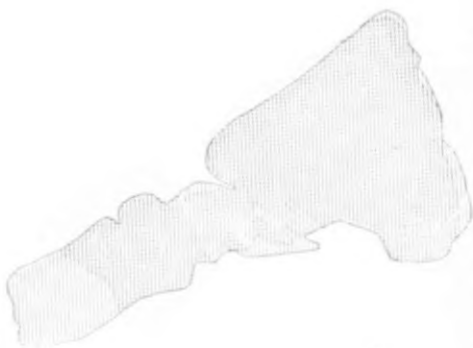
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PLATE XV.

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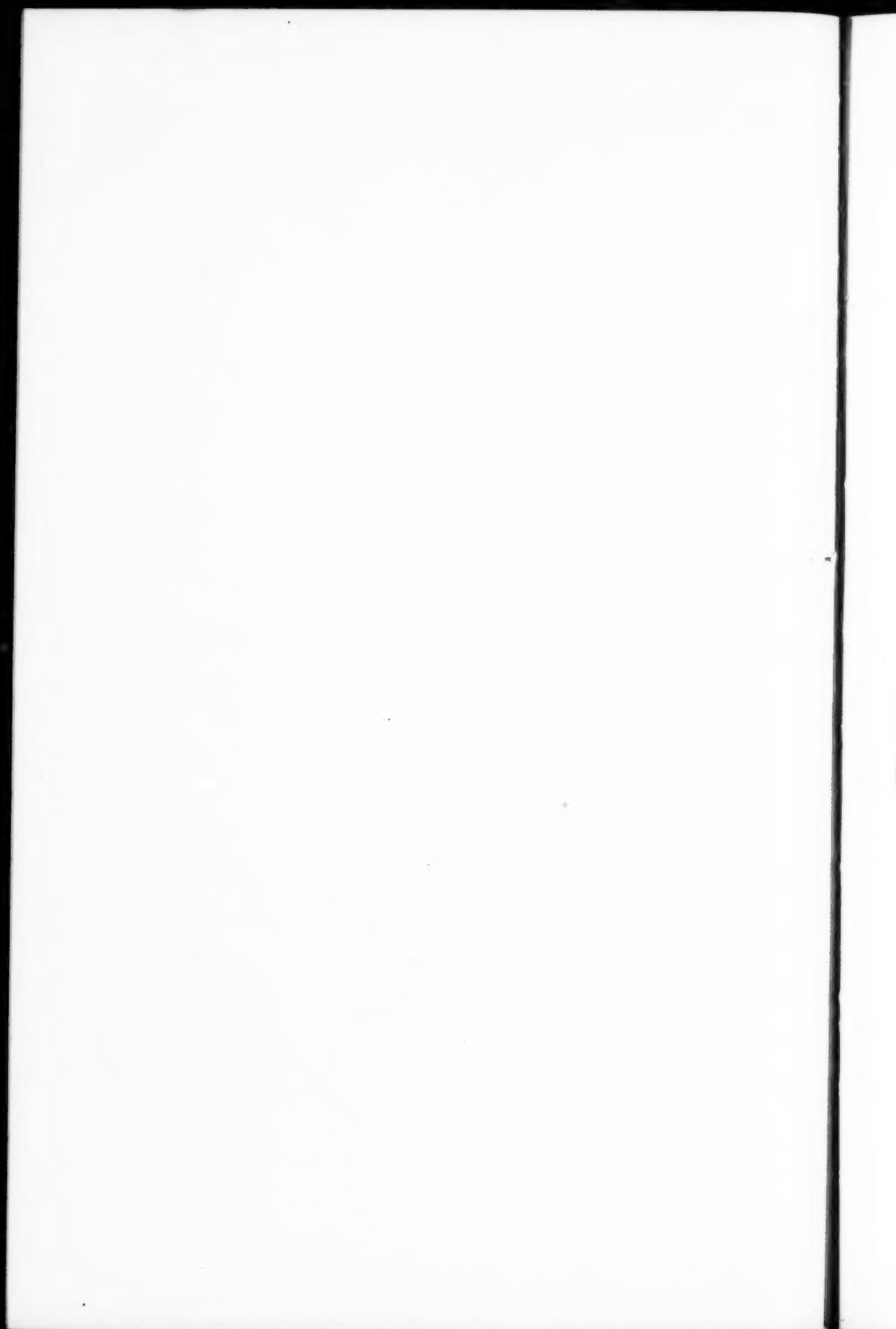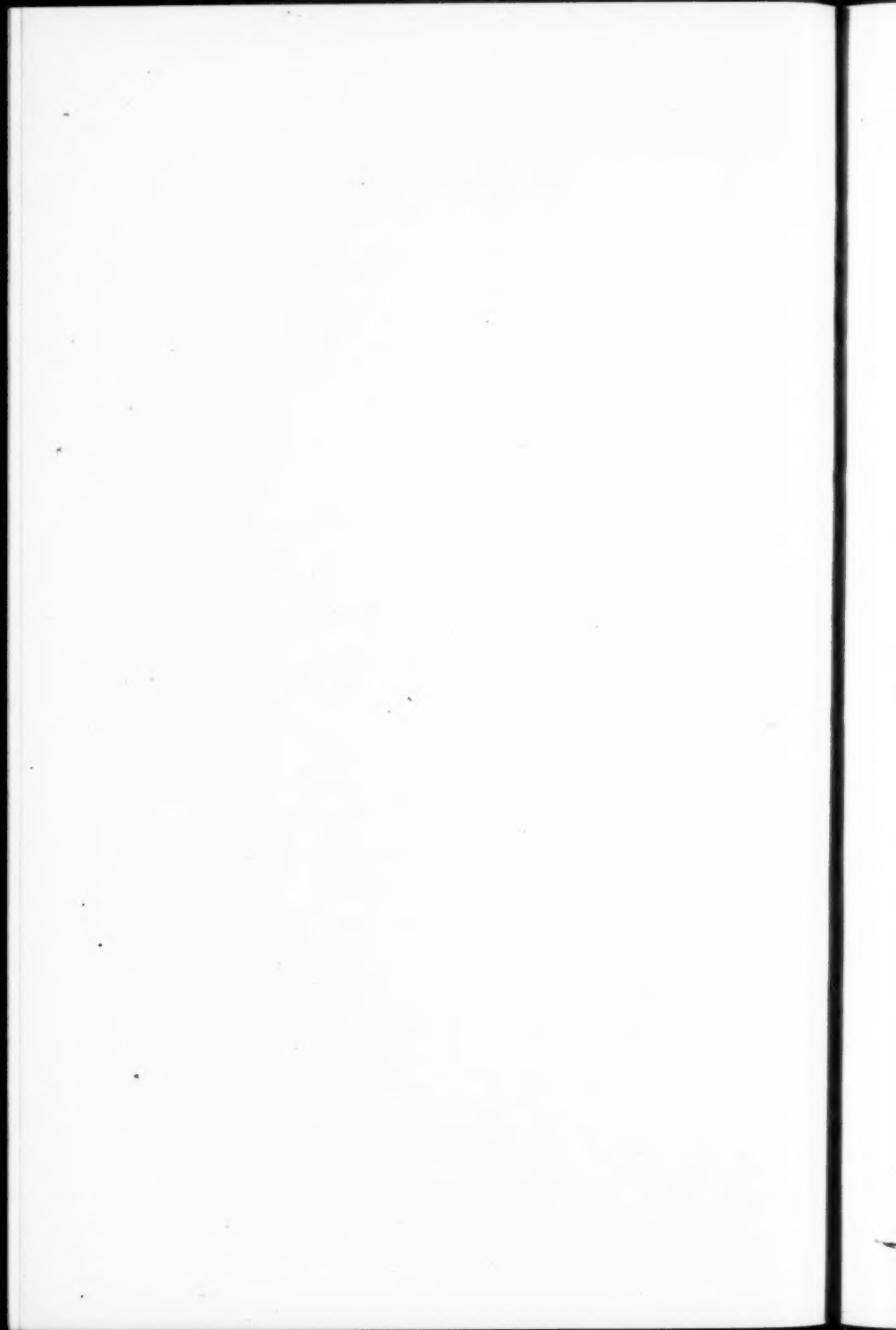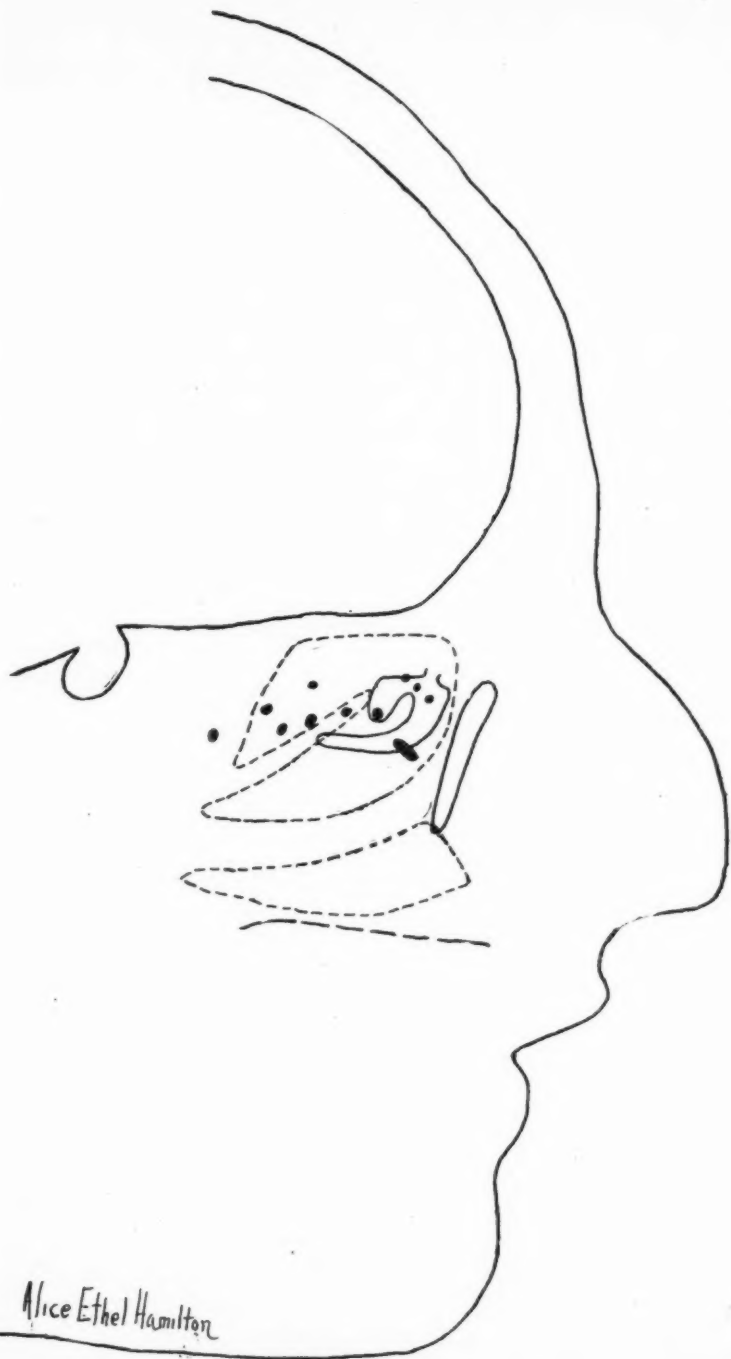
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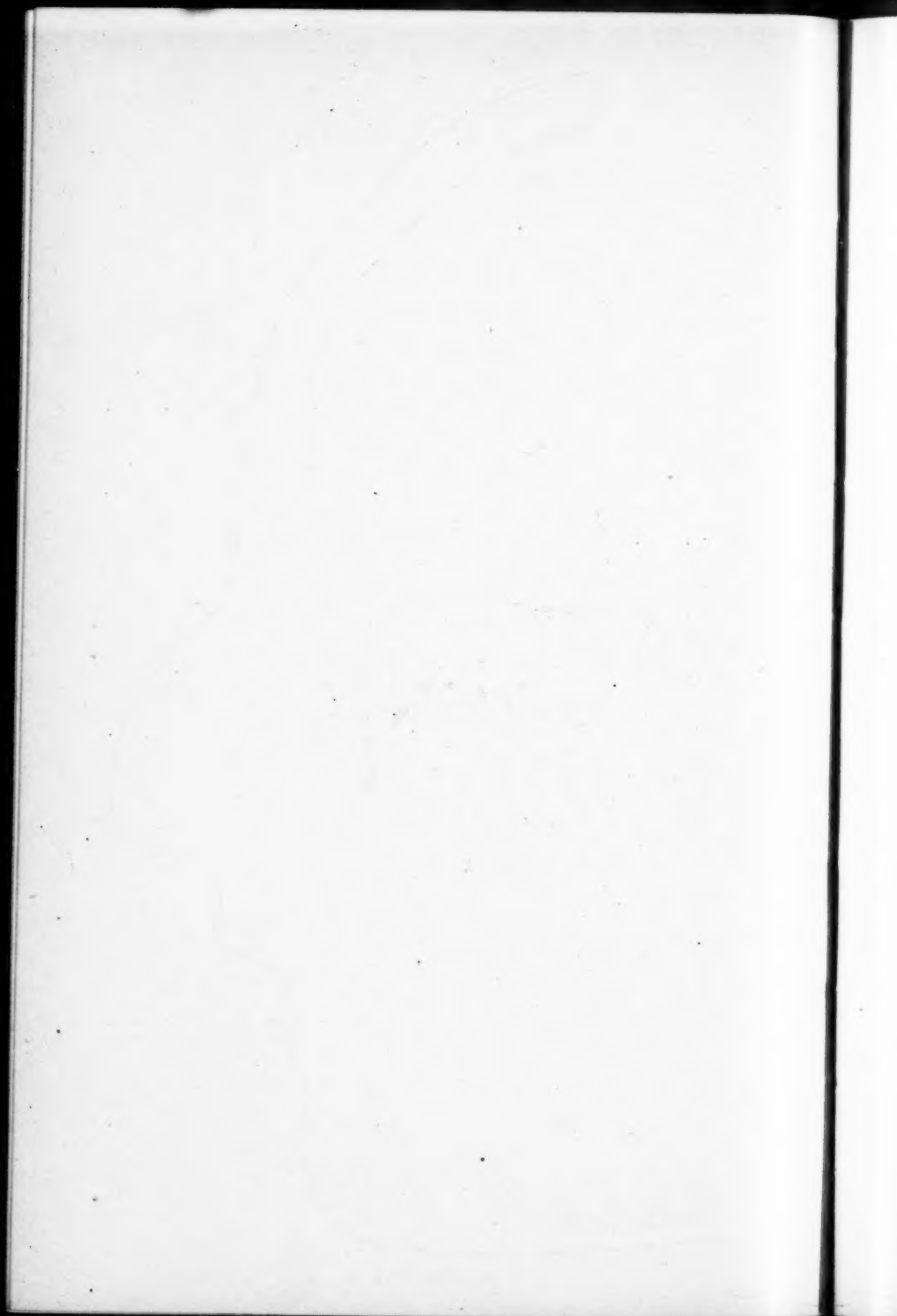
LIII.

THE FUNCTION OF THE ACCESSORY CAVITIES OF THE NOSE.*

By J. M. Ingersoll, A. M., M. D.

PROFESSOR OF OTO-LARYNGOLOGY WESTERN RESERVE
UNIVERSITY.

CLEVELAND.

The functions of most of the organs of the body are so well known that, with our present knowledge, these functions seem almost self-evident. There are, however, some organs which are apparently functionless and are usually considered vestigial or rudimentary. They were formerly of greater physiologic importance, but in the course of generations, in consequence of adaptation of the body to special conditions of life, they have been subjected to reduction or degeneration and now remain simply as vestiges. Their presence can be explained only by the theory of selection, and in this connection, two important factors must be considered, namely, heredity and the capability of variation.

Heredity is conservative and tends to retain the ancestral characters. The capability of variation is influenced by external conditions and results in the modification of structures. The resulting adaptations as far as they are useful to the organism concerned, are transmitted to future generations. Thus heredity and adaptation are parallel factors, and the knowledge of this fact helps us to explain the presence of various rudimentary organs in the adult.

With these general principles in mind, the study of the comparative anatomy of the accessory cavities of the nose, should teach us what their function has been and whether or not they are now functionally active in man.

FISHES.—In fishes there are no accessory cavities of the nose. Their nose is a simple sack-like structure and does not communicate with the mouth, except in Dipnoi.

Dipnoi are fishes which live in shallow streams, and while in the water breathe through their gills as other fishes do.

Their nose communicates with the mouth, and they have a functional lung and resemble reptiles in some other respects. In the dry season, they live in the mud and breathe through their nose, and thus the nose becomes a part of the respiratory system.

REPTILES.—In reptiles the nasal cavities are more complicated. Each nasal fossa is divided in a general way, into a respiratory portion, situated anteriorly, and an olfactory portion, situated in the posterior superior part of the nose. This olfactory region contains the sensory nerve cells, and a rolled turbinal springs from its outer wall.

BIRDS.—In birds the turbinals all show a higher degree of development. Their form varies greatly; some are simple prominences and some are decidedly scroll shaped or even present a double coil, the superior coil making one complete turn and the inferior coil making two or more turns within itself.

There are no accessory cavities of the nose, but the bones of the skull, like some of the other bones in birds, contain large air cells or cavities to make the bones lighter.

MAMMALS.—In mammals, the turbinals and the nasal accessory cavities exhibit great variations, each showing a high or low degree of development, according to the environment of the animal.

KANGAROO (Macropus.)—The kangaroo occupies quite a low position in the mammalian scale, but its nose is much more highly developed than the nose in any of the birds.

The nasal fossae are two symmetrical cavities completely separated from each other in the median line by the septum. The maxillary turbinals correspond to the inferior turbinals in man. There is one in the anterior part of each fossa. Each one projects outward and upward from the maxillary bone, beginning as a thin shelf-like process which divides into numerous curved branches partially filling the anterior half or respiratory portion of the nose (Plate I, Figures A and B, 2). The function of the maxillary turbinals is to prepare the inspired air for respiration.

The posterior part of the vomer gives off two lateral wings, one on each side, which extend across the nasal fossae and unite with the ethmoidal bones, thus dividing each fossa pos-

teriorly into two superimposed cavities (Plate I, Figures C and D, 6). The superior cavities contain most of the ethmoidal turbinals and constitute the olfactory portion of the nose. The inferior cavities are tube-like structures and form a direct communication between the anterior or respiratory portion of the nose and the nasopharynx (Plate I, Figures C and D, 7).

There are five ethmoidal turbinals in each fossa. They spring from the convex surface of the cribriform plate of the ethmoidal bone and give off numerous branches which extend anteriorly into the nose. Some of them articulate with and are supported by the frontal, nasal and superior maxillary bones, but none of them unite with the septum (Plate I, Figures B, C and D, 3). The numerous branching and curved processes of the ethmoidal turbinals are all covered by olfactory mucous membrane and thus a large surface is exposed in a comparatively small area. The function of the ethmoidal turbinals is olfactory.

The maxillary sinuses are simple diverticula between the anterior inferior parts of the ethmoidal turbinals and the superior maxillary bones (Plate I, Figure C, 5). They can hardly be called sinuses, but are rather large channels which lead from the respiratory portion of the nose to the external portion of the ethmoidal turbinals and thus bring a large olfactory surface in direct communication with the inspired air.

The ethmoidal cells are spaces between some of the branches of the ethmoidal turbinals and the adjacent bones of the skull (Plate I, Figures B and C, 4). They communicate direct'y with the maxillary sinuses and thus conduct the air over a still greater surface of the olfactory turbinals.

There are no frontal or sphenoidal sinuses in the kangaroo's skull. Thus in the kangaroo, the olfactory or ethmoidal turbinals are situated in the posterior superior part of the nose. Their internal surfaces are exposed directly to a part of the inspired air after it has passed through the branches of the maxillary turbinal. The maxillary and ethmoidal sinuses; which are the only ones present in the kangaroo, serve as channels to conduct some of the inspired air over the external lateral surfaces of the ethmoidal turbinals and so expose these portions of the olfactory turbinals more directly to the inspired air and are, therefore, functionally active in increasing the acuteness of the sense of smell.

DEER (Cervus).

A longitudinal section through the deer's head shows three ethmoidal turbinals (Plate II, Figure A, 2), and a large maxillary turbinal (Plate II, Figure A, 1), all of which present comparatively smooth surfaces. Transverse sections through these turbinals show them to be highly developed and very complicated structures.

The maxillary turbinal is a double coil. It springs from the superior maxillary bone as a thin shelf-like process, parallel to the floor of the nose, extending two-thirds of the way across the fossa. It then divides into two processes, the superior one makes three complete turns within itself and the inferior one makes two turns (Plate II, Figures B, C, D and E, 1).

There are three ethmoidal turbinals (Plate II, Figures A, C, D, E, F and G, 2). They arise from the convex surface of the cribriform plate of the ethmoidal bone, and at first consist of a mass of thin, delicate curved branches which intertwine with each other and almost completely fill the posterior superior part of each fossa (Plate II, Figure G, 2). As these branches extend anteriorly, they decrease in number and present broader and less convoluted surfaces (Plate II, Figure F, 2). The ethmoidal cells are cavities contained within these broader branches or between these branches and some of the surrounding bones of the skull (Plate II, Figure F, 7). The frontal sinuses are comparatively small cavities between the plates of the frontal bones and are partially filled by scrolls of the ethmoidal turbinals.

The maxillary sinuses are large cavities in the superior maxillary bones (Plate II, Figure F, 6). Their ostia are situated in the posterior part of each cavity and open into the nose in conjunction with some of the ethmoidal cells. Some processes of the ethmoidal turbinals extend into the maxillary sinuses.

In the deer, the accessory sinuses are more circumscribed and more definitely separated from the rest of the nasal fossae than they are in the kangaroo, but the sinuses all contain ethmoidal turbinal tissue and are a part of the olfactory portion of the nose.

PRAIRIE WOLF (Canis latrans).

The wolf's nose is more highly developed than the nose of

the kangaroo or the deer. The turbinals are all much more complicated and their branches are more numerous and convoluted so that the inspired air is brought in contact with a tremendous expanse of mucous membrane.

The anterior half of each nasal fossa is almost completely filled with the fine branches of the maxillary turbinal (Plate III, Figures A and B, 1). The lateral wings of the vomer divide the posterior portion of each nasal fossa into an olfactory and respiratory part as in the kangaroo and the deer (Plate III, Figures A, C and D, 17).

In each fossa there are seven ethmoidal turbinals radiating from the convex surface of the cribriform plate and their delicate intertwining scrolls form a dense labyrinth in the olfactory part of the nose (Plate III, Figures A, C and D, 2). They articulate with the lateral wings of the vomer, the superior maxillary, frontal and nasal bones.

The maxillary sinus (one in each fossa) is an irregularly oval cavity between the ethmoidal turbinals and the superior maxillary bone (Plate III, Figures C and D, 11). Its posterior part is entirely shut off from the nasal fossa by the ethmoidal bone but anteriorly it is only partially separated from the nose by some scrolls of the ethmoidal turbinal. It acts as a channel to conduct some of the inspired air over the external lateral surface of the olfactory turbinals and thus produces a keener sense of smell. It is therefore, a part of the olfactory portion of the nose.

The ethmoidal cells are irregular spaces between the ethmoidal turbinals and the surrounding bones of the skull and contain scroll-shaped branches of the ethmoidal turbinal which spring directly from the cribriform plate (Plate III, Figure A, 4),

There is one frontal sinus in each half of the skull. It is an irregular cavity between the two plates of the frontal bone (Plate III, Figure A, 6). Anteriorly it communicates directly with the ethmoidal cells and contains a double coil of the ethmoidal turbinal.

The sphenoidal sinus is simply a slight depression in the anterior part of the sphenoidal bone and is filled by an ethmoidal turbinal scroll.

All the accessory sinuses of the nose in the wolf are therefore a part of the olfactory portion of the nose and all contain olfactory turbinal tissue. Their function is to conduct

the air over a part of the olfactory turbinals which would not
be otherwise directly exposed to the inspired air, and thus in-
crease the acuteness of the sense of smell.

APES. Indian Ape (Macacus rhesus).

The ape's nose is a very much degenerated structure. The
maxillary turbinal is a slightly curved bone and is very sim-
ilar in outline and position to the corresponding turbinal in
man (Plate IV, Figure B, 1). There are two ethmoidal tur-
binals in each fossa (Plate IV, Figures A, B and C, 2 and 3).
The larger one projects downward and forward from the eth-
moidal bone and divides into two branches (Plate IV, Figures
A, B and C, 2). The smaller one is more scroll-shaped but
both of these turbinals have lost the numerous, fine, convoluted
branches which are present in lower animals, and the other
ethmoidal turbinals (third, fourth and fifth) have entirely dis-
appeared.

The maxillary sinus is situated within the maxillary bone
and opens into the middle meatus through a small ostium, con-
siderably above the floor of the sinus. Its walls are smooth
and it contains no ethmoidal turbinal tissue (Plate IV, Figures
A, B and C, 10). The other accessory sinuses of the nose have
disappeared completely and the space which they occupied in
the frontal and sphenoidal bones in lower animals, is filled
with cancellous bone.

GIBBON or long-armed Ape (Hylobates).

The gibbon's nose is less degenerated than the nose of many
other apes. The maxillary turbinal has a double coil (Plate
V, Figures A, B and C, 1). There are two well-defined eth-
moidal turbinals (Plate V, Figures A, B and C, 2 and 3),
and three small ethmoidal cells. The maxillary sinus is com-
paratively large and communicates with the nasal fossa through
a small ostium, high up in the middle meatus (Plate V, Fig-
ures B and C, 10). The sphenoidal sinus is very large and
opens into the superior meatus through a small ostium (Plate
V, Figure A, 6). There are no ethmoidal turbinals in the
maxillary or sphenoidal sinuses. The frontal sinuses are ab-
sent and in their place there is cancellous bone.

In apes, as a class, all the turbinals have degenerated and
show a comparatively simple structure. The accessory

sinuses present numerous variations. The maxillary sinus is always present and usually has smooth walls and a small ostium opening into the middle meatus. In some of the lower orders of monkeys, the ostium remains quite large and a small branch of the ethmoidal turbinal projects into the sinus.

The frontal sinus is present in the chimpanzee. In other apes it is absent and the frontal bone is cancellous.

The ethmoidal cells vary greatly in size and number. In some apes, there are none and the ethmoidal turbinals are very rudimentary. In others, there are several ethmoidal cells and the ethmoidal turbinals are not so much degenerated as they are in the apes, which have no ethmoidal cells. The variations in the sphenoidal sinuses are similar to those in the ethmoidal cells. In those apes in which these sinuses are absent, the ethmoidal turbinals are more degenerated and · the ethmoidal cells are also absent.

MAN.

The general characteristics of the accessory cavities of the nose in man are well known. They present numerous variations, many of which are reversions to more primitive types. The absence of one or both frontal sinuses corresponds to the absence of these sinuses in most apes. The ethmoidal sinuses are cells surrounded by some of the numerous branches of the ethmoidal and adjacent bones and occasionally contain small ethmoidal turbinal scrolls, as they always do in such animals as the wolf. The subdivision of one or both sphenoidal sinuses into two or more cavities corresponds to a similar division of these sinuses in some of the lower animals in which the ethmoidal turbinals extend into the sphenoidal sinuses and produce numerous subdivisions. The irregular ridges sometimes seen on the lateral walls of the maxillary sinuses are probably rudiments of the . ethmoidal turbinals which extend directly into the sinuses in some animals, and in certain species are attached to the sinus walls.

The accessory sinuses in the lower animals are developed, therefore, in conection with the olfactory portion of the nose. They are rather simple channels which conduct some of the inspired air over the external lateral surfaces of the olfactory turbinals.

In animals which have an acute sense of smell, the olfactory (ethmoidal) turbinals exhibit a tremendously intricate development and the accessory sinuses are correspondingly more highly developed, and all of them contain olfactory turbinal tissue. Their function is to conduct the inspired air more directly over a large surface of the olfactory turbinals, which would not otherwise be exposed to the air except by diffusion, and thus the accessory sinues increase the acuteness of the sense of smell.

In those animals in which the sense of smell is not acute, the olfactory turbinals have degenerated and receded from the accessory cavities. The cavities are left with comparatively smooth walls, their openings into the nasal fossae contract and their functional activity is lost.

In man the accessory cavities are almost completely shut off from the nose, their functional activity ceases, and they remain as rudimentary structures.
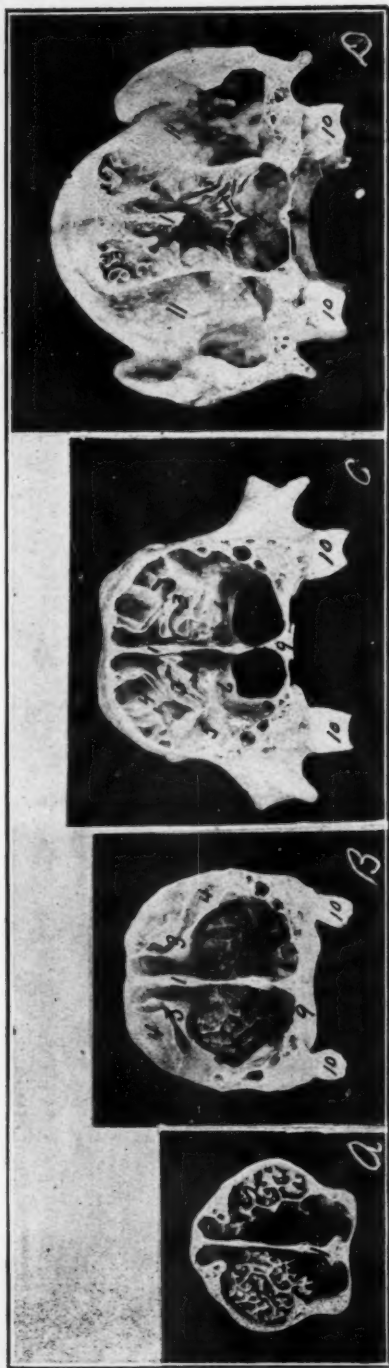
PLATE I KANGAROO (Macropus).

Transverse sections through a kangaroo's skull, showing both nasal fossae. A and B, looking anteriorly; C and D, looking posteriorly.

1. Nasal septum.
2. Maxillary turbinals.
4. Ethmoidal sinuses.
5. Maxillary sinuses.
6. Lateral wings of vomer.
7. Respiratory tract in the posterior inferior part of the nose.
8. Cribriform plate of the ethmoidal bone.
9. Palate.
10. Teeth.
11. Orbit.

PLATE II DEER (Cervus).

A. the left nasal fossa of a deer. B to G, transverse sections through both nasal fossae of a deer. B, D, E, F and G, looking posteriorly. C, looking anteriorly.

1. Maxillary turbinals.
2. Ethmoidal turbinals.
3. Brain cavity.
4. Posterior nares.
5. Septum.
6. Maxillary sinus.

7. Ethmoidal cells.
8. Palate.
9. Teeth.
10. Orbit.
11. Lateral wings of vomer.
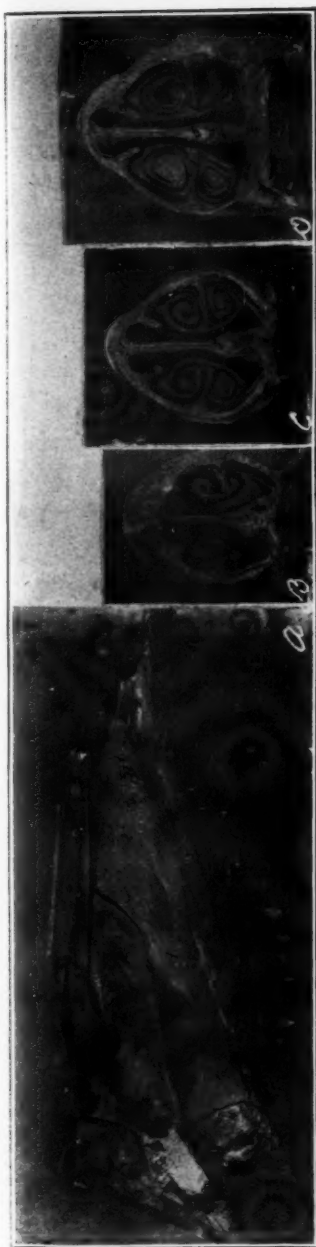
PLATE II

PLATE III. PRAIRIE WOLF (Canis latrans).

A, longitudinal section through a wolf's skull, showing the right nasal fossa. B, C and D, transverse sections through a wolf's skull showing both nasal fossae. B and C, looking anteriorly; D, looking posteriorly. (In Fig. B, the nasal septum is absent, having been lost in maceration.)

1. Maxillary turbinal.
2. Ethmoidal turbinal.
3. Ostium maxillare.
4. Ethmoidal turbinal in ethmoidal cells.
5. Ethmoidal turbinal in frontal sinus.
6. Frontal sinus exposed by removing its internal wall.
7. Cribriform plate.
8. Ethmoidal turbinal in sphenoidal sinus.
9. Brain cavity.
10. Posterior nares.
11. Maxillary sinus.
12. Ethmoidal turbinal extending into the maxillary sinus.
13. Orbit.
14. Palate.
15. Teeth.
16. Vomer.
17. Lateral wings of vomer.
18. Septum.
19. Respiratory tract in the posterior inferior part of the nares.
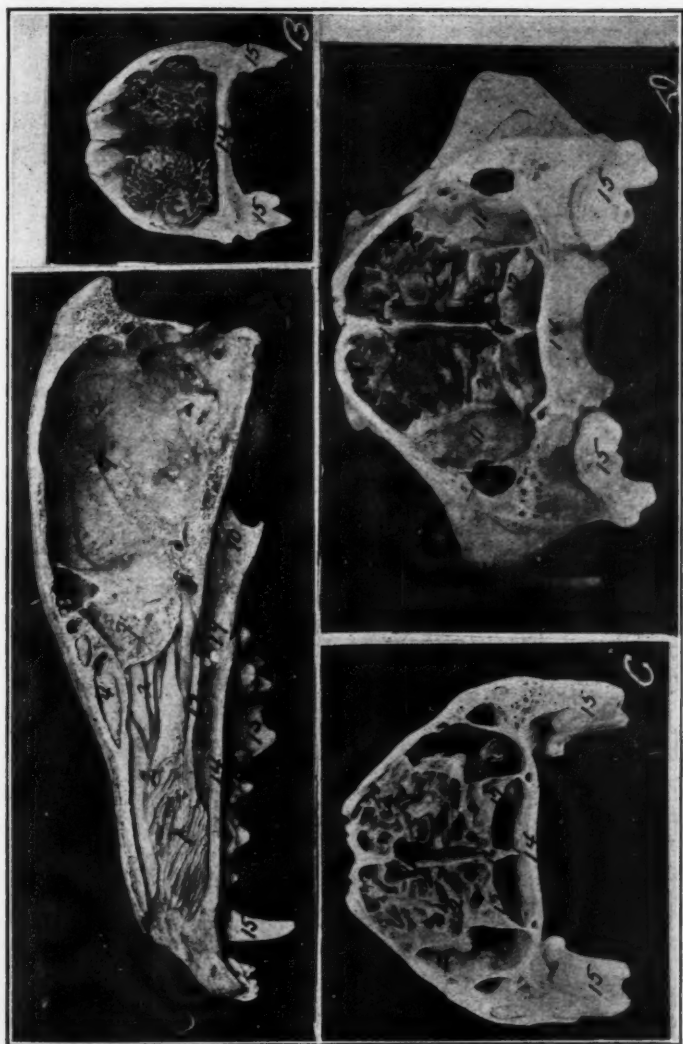
PLATE III.
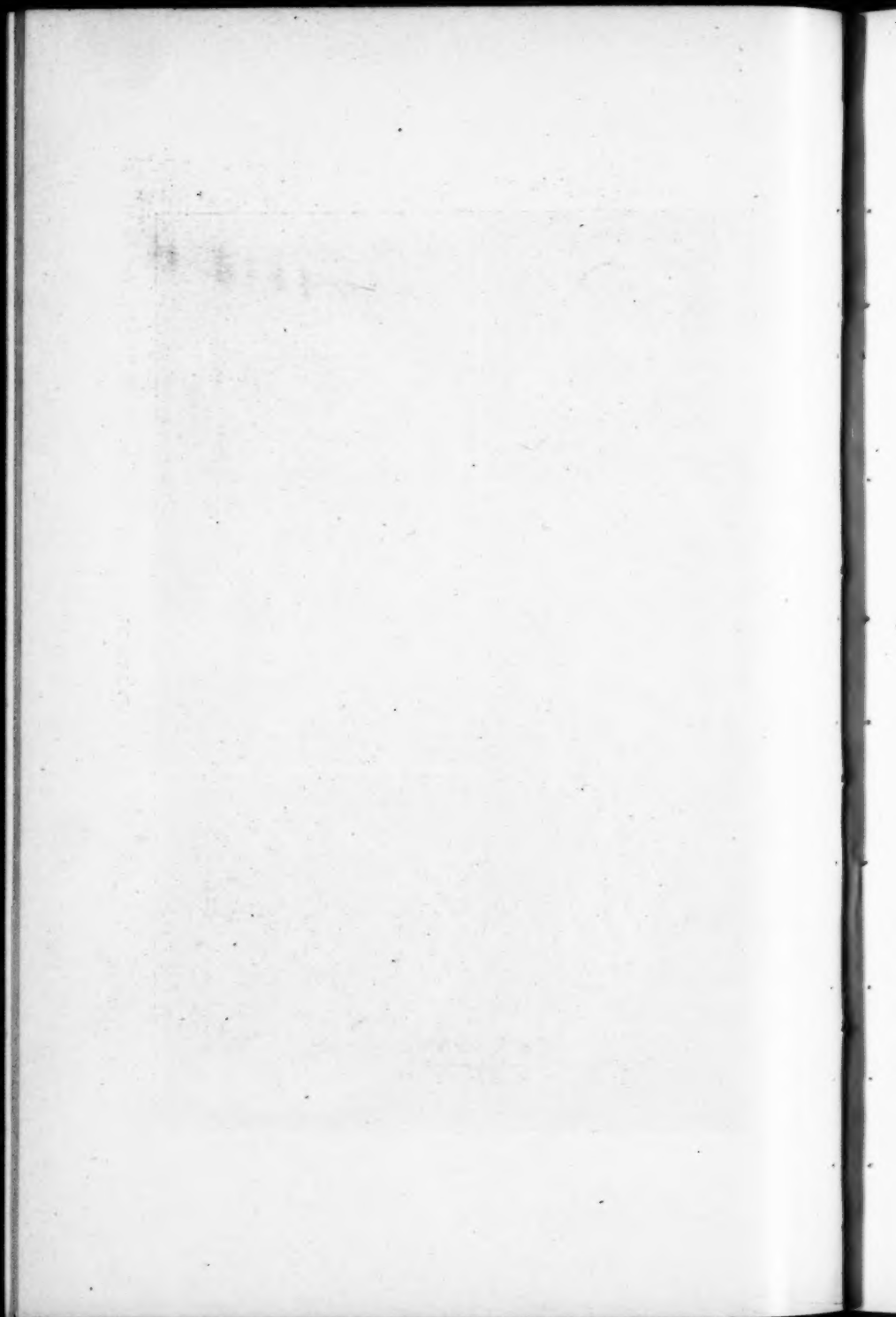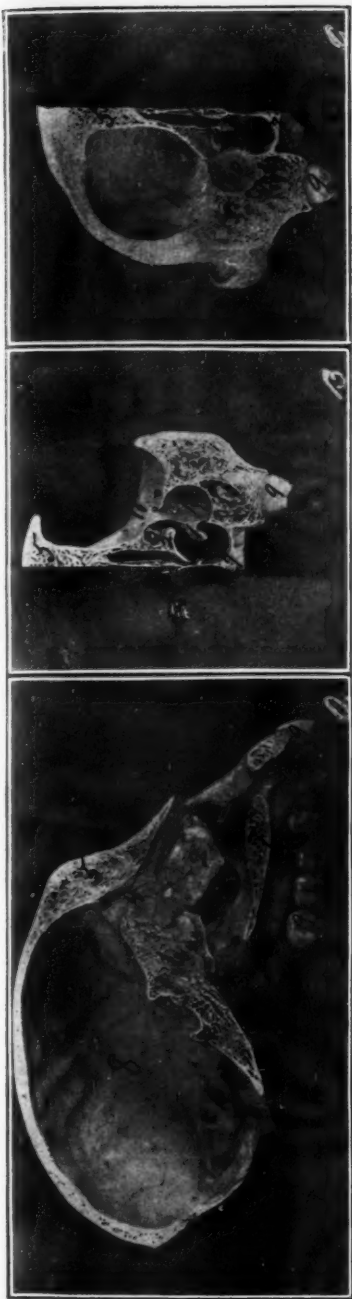
PLATE IV. INDIAN APE (Macacus rhesus).

A, longitudinal section through ape's skull, showing the left nasal fossa. B and C, transverse section through the right nasal fossa of an ape. B, looking anteriorly; C, looking posteriorly.

1. Maxillary (inferior) turbinal.
2. Ethmoidal (middle) turbinal.
3. Ethmoidal (superior) turbinal.
4. Cribiform plate of ethmoidal bone.
5. Cancellous frontal bone.
6. Cancellous sphenoidal bone.
7. Palate.
8. Brain cavity.
9. Teeth.
10. Maxillary sinus.
11. Orbit.
12. Nasal septum.

In Fig. A, the maxillary turbinal has been lost in maceration and the maxillary sinus (10) is exposed.
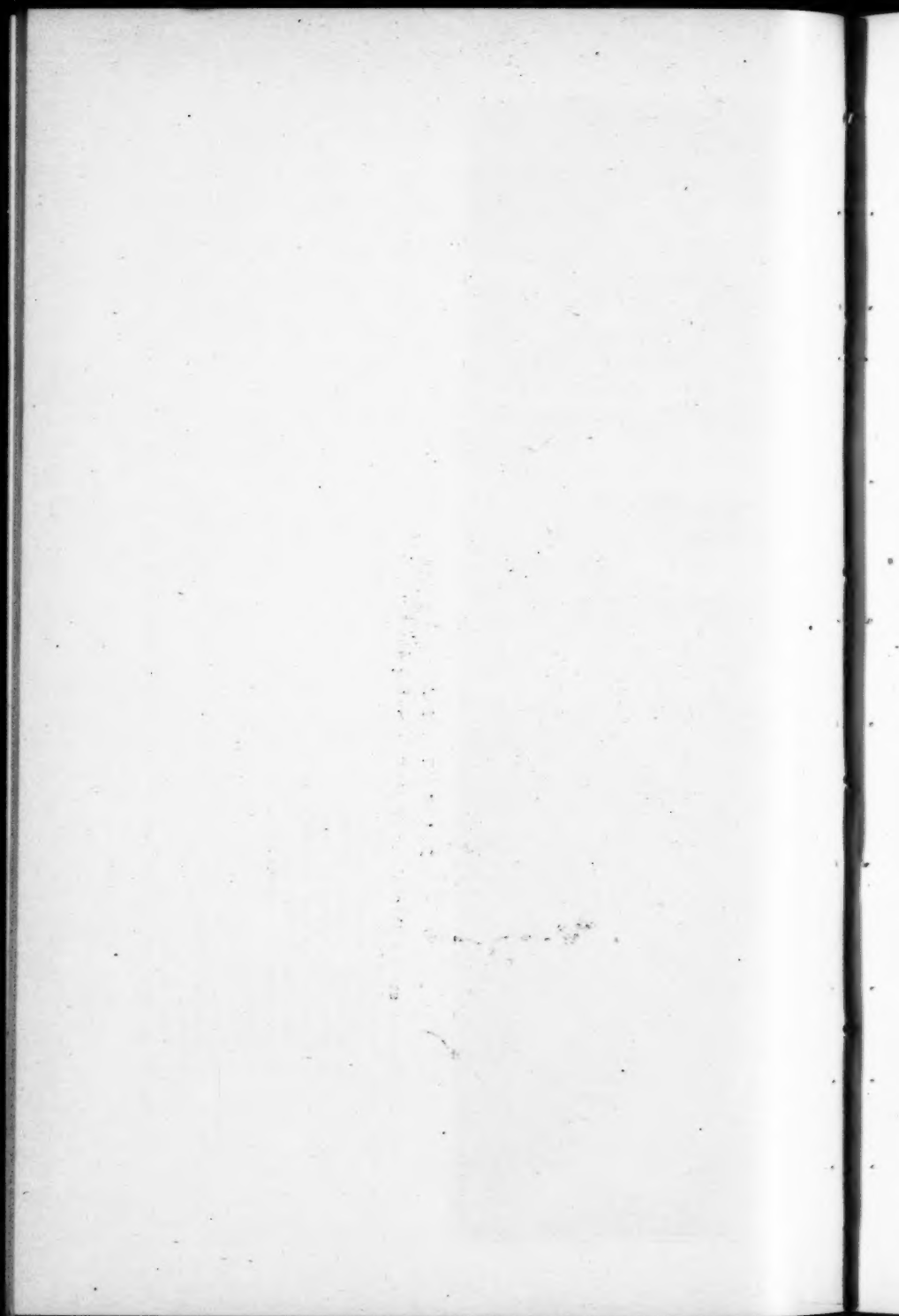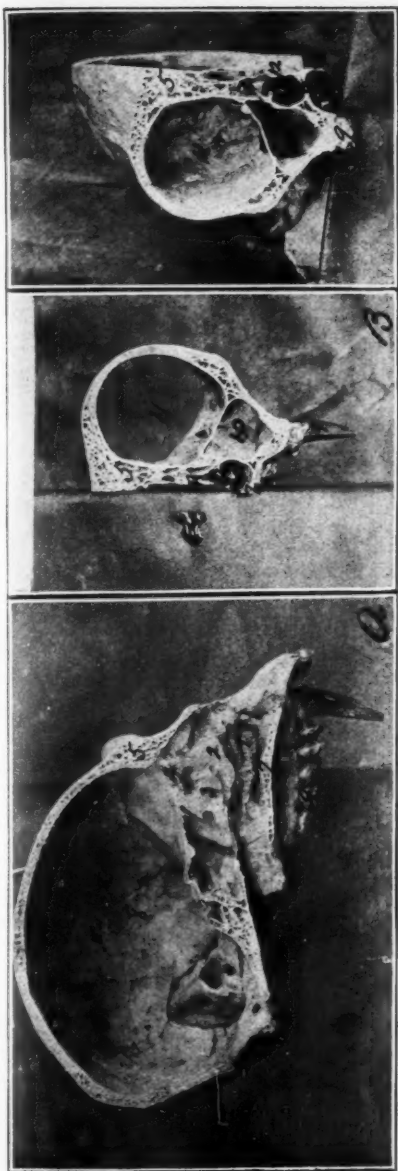
PLATE V. GIBBON (Hylobates.)

A, longitudinal section through a gibbon's skull, showing the left nasal fossa. B and C, transverse sections through the right nasal fossa of a gibbon. B, looking anteriorly; C, looking posteriorly.

1. Maxillary (inferior) turbinal.
2. Ethmoidal (middle) turbinal.
3. Ethmoidal (superior) turbinal.
4. Cribriform plate of ethmoidal bone.
5. Cancellous frontal bone.
6. Large sphenoidal sinus.
7. Palate.
8. Brain cavity.
9. Teeth.
10. Maxillary sinus.
11. Orbit.
12. Nasal septum.
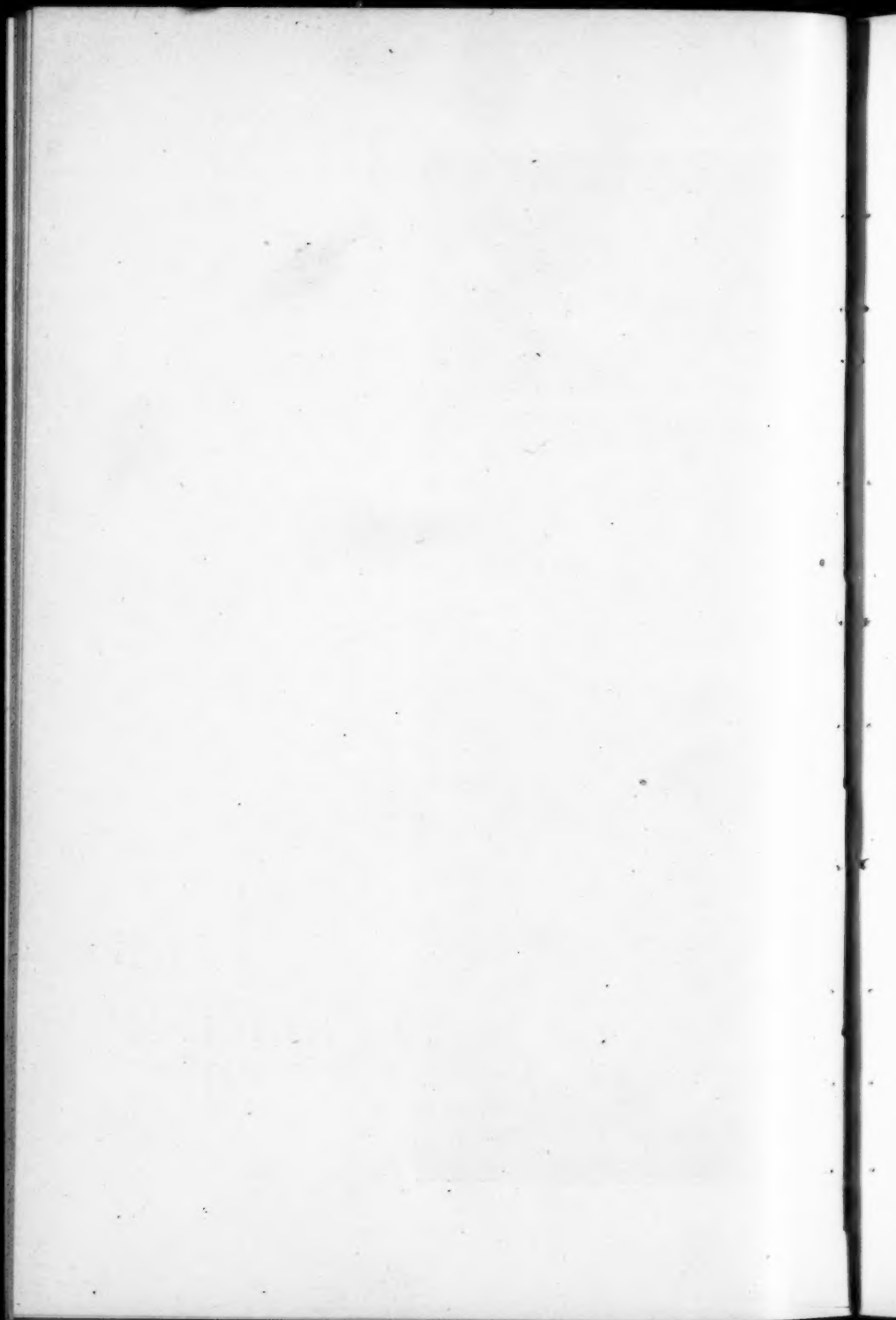
LIV.

GENERAL PATHOLOGIC PROCESSES ASSOCIATED WITH OR FOLLOWING INFECTIONS OF THE ACCESSORY SINUSES.*

By D. BRADEN KYLE, M. D.,

PROFESSOR OF LARYNGOLOGY IN JEFFERSON MEDICAL COLLEGE.

PHILADELPHIA.

Pathologic alterations of the structures of the accessory sinuses may be divided into two classes, according to the tissues involved: First, we have the changes affecting the mucous membrane alone, and, second, those involving the deeper structures or bony framework.

The accessory sinuses are, for all practical purposes, closed cavities, and while the mucous membrane lining these cavities is similar to that of the upper respiratory tract, yet the glandular elements and the terminal nerve filaments are not nearly so numerous as in the exposed mucous membrane. The epithelial layer of the membrane is also much thinner and the cells resemble more those of the endothelial type, and the mucous membrane, therefore, has less resisting power.

Inflammatory processes involving this structure do not differ from those occurring in any other mucous membrane, with the exception that they pass through the various stages with greater rapidity, so that the difference is merely one of degree or intensity. Any infection of the accessory cavities would necessarily be preceded by or associated with some inflammatory process, which process involves the opening of the sinus and thus converts it into a closed cavity, causing retention of the infectious material. This in turn intensifies the already existing inflammation and produces rapid changes in the mucous membrane, which, if drainage is not established, may lead to total destruction of the membrane and necrosis of the

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underlying bony structure. If the severity of the inflammatory process is not sufficient to cause destruction of the mucous membrane and denudation of the bony walls of the cavity, a fibroid formation within the basement membrane may take place, or in other words, the physiologic function is interfered with, resulting in permanent pathologic alteration.

When there has been a destruction of the mucous membrane lining these cavities, it is not likely to be regenerated, owing to the fact that the blood supply to the submucosa is not so profuse as in the respiratory tract, and also that the genetic layer of the epithelial surface is less substantial and less capable of reproduction.

I have observed in a few cases, where the accessory cavities had been freely opened, that the pathologic alteration accompanying the process had not produced a permanent lesion, and when the cause was removed the mucous membrane returned to the normal, but the practically closed cavity had been converted into a wide-open one and the patient suffered from symptoms almost identical with those of confined suppuration of these cavities, such as faceache, the neuralgia, sense of pressure, the general discomfort with, of course, no rise in temperature. One of these cases in particular, I have watched for the past three years. This individual had six accessory cavities opened and the delicate, sensitive mucous membrane, which was not physiologically intended to come in contact with the air and dust, was particularly susceptible to the slightest climatic changes. It was found by placing the patient in a room with an even temperature, that almost instant relief was obtained, and I believe that all the symptoms were produced by the use or misuse of these sinuses, as they are not intended as respiratory cavities. By stimulation following the use of these cavities, and the increase in the blood supply of the exposed mucous membrane as a result of this stimulation, the membrane has gradually thickened and, in other words, has physiologically changed, and while it may be somewhat of a pathologic process, it has produced a physiologic result and lessened the sensitiveness of these cavities and developed the membrane. During the past winter the patient has had practically no symptoms of any involvement of these sinuses.

As a rule, confined suppuration within the accessory cavities show irregular systemic symptoms, unless there is a point where the physiologic wall of the closed cavity has broken down, and rapid general septic infection takes place, when the clinical phenomena are pronounced. In other words, infection of the accessory cavities amounts to a walled-in process, and it is only when necrosis takes place that systemic infection occurs.

Infection of the accessory cavities is usually secondary to or associated with lesions of the adjacent structures, and in a large majority of cases, the etiologic factor may be found in the nasal cavity. The continuation of the pathologic process within the accessory cavity will depend entirely upon the pre-existing condition within the nasal cavity. While the pathologic alteration occurring within the cavity is a definite and distinct one, the arrest of that process is subject to the same general law which is the basis of all surgical treatment, namely, the removal of the cause. If the infection is due to the pneumococcus, streptococcus or bacillus of influenza, there is a marked tendency to bony necrosis.

A point of considerable importance, as regards the invasion of surrounding structures by the pathologic process, as well as accounting for the varied symptoms produced, is the size and shape of the cavity and the variations in the thickness of its walls. For example, a frontal sinus with thin walls may result in perforation and involvement of the brain cavity. Dural and subdural abscesses frequently follow pathologic changes within the frontal sinus. Again, in the case of the antrum of Highmore, where the superior wall is very thin, you will have marked eye symptoms, while in another case with a thick bony wall, the eye symptoms will be entirely absent. The spreading of an infectious process from one accessory cavity to another is usually explained by some abnormal communication.

Irregularities and abnormalities as to the formation of the accessory cavities, the antrum, etc., may explain many of the peculiar and unique cases often reported. It has been shown by sections of the skull, with a view to demonstration of the relation of the accessory cavities to the nasal chamber, that almost any size or shape of cavity or thickness of bone is possible, the antrum cavities varying in size from a little larger

than a pea to three times the usual size and extending under
the floor of the nose.

In cases associated with nasal lesions, it is quite likely that
the chronic inflammatory process set up in the floor of the
nose may interfere with the nervous and vascular supply of
the tooth directly under it, causing a trophic function with
devitalization.

Recent clinical observations have clearly proven that many
lesions of the head and face suggesting antral disease, the
cause of which has been more or less obscure, have their
origin in abnormal or pathologic conditions of the dental
organs, such as teeth irrupted into the nose or antrum, or dis-
eased teeth affecting either cavity.

Irregularities in the formation of the accessory cavities
will bring about irregularity in the upper arch and predis-
pose to dental lesions as well as nasal disease. This is not
only caused by nasal obstruction and improper passage of air,
but also by poor nutrition, as the current of air passing to
and fro in the nostril stimulates circulation in the nasal mu-
cous membrane. One-half of the arc of the orbit is taken up
by the accessory cavities and many eye symptoms are asso-
ciated with or follow lesions of these cavities. Orbital ab-
scess is secondary to disease of the sinuses, displacement
of the globe may be occasioned by encroachment on the orbit
by a distended sinus, and blindness may result from an in-
volvement of the chiasm through the roof of the cavity or
by an implication of the optic nerve as it passes through its
foramen in the sphenoid, as a consequence of inflammation in
the cells within that bone. A general orbital cellulitis may
be occasioned by an acute perforation of any sinus. Edema
of the lids is one of the most significant symptoms of dis-
ease of the accessory sinuses and is to be distinguished from
the inflammatory swelling and thickness of the lid which re-
sults from cellulitis, as it is entirely non-inflammatory in ori-
gin. Paresis, and even paralysis, of one or more of the eye
muscles may occur as a consequence of sinusitis.

The sphenoid and ethmoid cavities, being in reality noth-
ing more than honeycomb cells, an infectious pathologic
process occurring within these cavities is extremely likely
to produce bony necrosis, if the infectious process is of suf-
ficient severity to cause necrosis of the mucous membrane.

The delicate bony structure is dependent upon its blood supply coming from the mucous membrane; this is not true of the frontal sinus and antral cavity. In the latter cavities the bone may be denuded of mucous membrane with no necrosis of the bony structure. In other words, bony necrosis is more likely to occur within the ethmoid and sphenoid cavities. The pathologic changes in the sphenoid and ethmoid cavities, following infections, even after the cavities are opened, is more likely to continue than in the frontal or antral cavity. In the latter, better drainage can be established, and the infectious material can be more thoroughly eradicated; in other words, more complete surgical interference can be employed in the antral and frontal cavities than in the sphenoidal and ethmoidal.

Meningitis and sinus involvement is likely to follow frontal, ethmoidal and sphenoidal sinusitis. Occasionally, cases are seen in which infections of these cavities produce practically no symptoms.

I recall a case which came under my observation in 1899 and which I reported at that time. The patient, a woman of sixty years, after being indisposed for a few days, experienced a sensation of fullness on the left side of the nose, opposite the inner angle of the orbit. There was no pain, only a sense of uncomfortable fullness. There was a considerable discharge from the nose of a thin, watery secretion; the character of the secretion varied slightly in the morning, when it was thick and tenacious. There was a great deal of swelling over the face, especially between the eyes, which gave a peculiar facial expression, as though the eyes were wide set. There was not much tenderness on pressure over the swollen area. There was, however, some soreness at the inner angle of the eye over the region of the ethmoid cells. During the month of February, the symptoms first being noticed in January, the patient had quite a severe attack of epidemic influenza or la grippe. She was confined to her house about a month. During this attack there was practically no change in the condition of the forehead. The swelling remained about the same, and there was possibly a slight increase in the clinical phenomena. However, after the patient was able to be up, which was about the first of April, the swelling became more marked, especially under the eyes and on the left side in the region of the nasion, about an inch and

a half above the base of the nose.   There was considerable
discharge from the nostril, possibly more pus-like, although
nothing more than would be from an ordinary continued
rhinitis.   There was more soreness at this time, although not
painful; the patient complained of malaise and a peculiar sick
feeling; there was marked general debility, and the patient
seemed to be failing very fast in general health.   Prior to
this attack she had been in the best of health—had never up
to that time even suffered from a headache.   During the
month of May the patient developed marked swelling in the
limbs—in fact, all the symptoms were aggravated; there
were sore spots here and there over the limbs, with some
petechiae and slight inflammation.   There was constant shift-
ing of these spots.   There were pronounced aching about the
joints and symptoms of a decided rheumatic condition ˙or
gouty diathesis.   There was very little change in the swell-
ing of the face; if any difference, it was more marked.   At
no time was there any acute pain, the prominent symptom
being the edematous condition.   The patient had lost over
thirty pounds in flesh, and was quite weak and debilitated.
The last of June she consulted me, when I found the following
ing conditions present:

The tissue on the forehead was so swollen that it hung
down over both supraorbital ridges, with marked swelling
under both eyes, especially the left, giving the patient's face
a most peculiar appearance.   In the median line, about an
inch above the line of the supraorbital ridge, was a marked
projection, almost tumor-like, with distinct redness, and some-
what pitted in the center, with a small spot on which there
was some dried secretion.   On examination of the nose I
found practically no discharge on the right side, only a
slightly catarrhal inflammation; the left side was markedly
edematous; the mucous membrane was covered with a thin
glairy discharge with tendency to accumulation.   The upper
part of the nostril was so edematous and swollen as to com-
pletely occlude the cavity.   This tissue was depleted by the
local use of an 8 per cent solution of cocain, and after re-
traction of the tissue I could elicit no discharge from the
openings of any of the accessory cavities. After the use of
the cocain, there was perfect breathing through the nostril.
There was practically no pathologic alteration within the

nasal structure, the septum being almost straight, and there was enlargement of the turbinal bodies or lining membrane. Transillumination was resorted to, from a diagnostic standpoint, and the antra showed a perfectly clear outline. I was unable to make any satisfactory illumination of the frontal sinus or of the upper portion of the nose; however, I believed I had to deal with a confined suppuration in the left frontal sinus, or possibly involving both sinuses. In passing a probe over the skin at the point bulging with pitting, on removal of the slight crust formation I found that the necrotic tissue had given way and the abscess was already opened externally. On pressure, and by the patient leaning forward, there was a discharge of foul-smelling thick pus, and by slight digital examination I found that there was a necrotic area, almost circular, about three-fourths of an inch in diameter. I then passed a probe into the opening, and, allowing it to follow the line of least resistance, it passed down without any force whatever, until it lodged against a soft material. By tapping it gently I felt that it was necrotic bone. With a little pressure the probe passed through into the nasal cavity. At the same time light was reflected into the nostril, and the point of the probe could be seen on the septum side of the middle turbinate, about the middle third. I then had free drainage. After the discharge of pus the sense of fullness at the inner angle of the orbit, which had continued from the first, entirely disappeared. The cavity was flushed out with warm boric acid solution, followed by hydrogen peroxid, cinnamon water and aqueous extract of hamamelis, equal parts. Within forty-eight hours the swelling had entirely disappeared from the face. The time from the spontaneous opening of the abscess until the complete closure of the wound was about two months. Occasionally, the external opening would become occluded with dried secretion with slight return of the facial swelling; on reestablishment of drainage this quickly disappeared. The patient's general health was improved by internal medication. Urinary examination showed no structural lesion of the kidney, but some leakage of serum albumin, possibly from the relaxed blood vessels.

From a general pathologic standpoint, we should remember that the accessory cavities are truly such and that they are not independent cavities; that they are accessory cavi-

ties to what? to the nasal respiratory tract. Hence, the origin of many pathologic lesions is the nasal cavity. We must remember, also, that these accessory cavities are dependent upon adjacent structures for nutrition. Also, when infected, you are dealing with a closed cavity, but not a cavity of new formation, hence the pathologic alteration is not subject to the same law as that of a cavity of new formation.

LV.

GASTROSCOPY.

By CHEVALIER JACKSON, M. D.,

PITTSBURG, PA.

The treatment, medical and surgical, of gastric diseases is not, and should not be, within the province of the laryngologist. Yet, judging from results that I have obtained, direct inspection of the stomach is not difficult to one skilled at esophagoscopy, as every laryngologist is or should be, provided he has a proper instrument.

No practical instrument of this kind for passage through the esophagus has ever been produced heretofore, but with the gastroscope herewith illustrated, inspection of certain portions of the stomach is easier than bronchoscopy per vias naturales.

Until the procedure shall have been extensively taught in post-graduate schools and opportunities thus afforded for experience, the work will have to be done by the rhino-laryngologist. Long trained in the examination of deep-seated mucous membranes by artificial illumination, he can see at a glance varying conditions of the mucosa that would not be evident to another. He is accustomed to relax the accommodation of one eye and to ignore its image, while looking at deep mucosæ with the other. Furthermore, his familiarity with esophageal instrumentation renders him facile at passing the instrument and especially at the starting of it.

Having aided the physician and surgeon in the diagnosis, the laryngologist's active concern in the case should cease; the day will come when the gastrologist and the general physician and surgeon will pass the gastroscope as frequently as the gynecologist now passes the cystoscope.

Usefulness. Gastroscopy is not simply a feat. It has a field of usefulness that will increase as our skill and knowledge increase.

With the gastroscope I have made a diagnosis of gastritis in one case, of gastroptosis in one case, of malignant disease

of the pylorus in one case, malignant disease of the cardia in one case, peptic ulcer in three cases, one of which was cured by direct applications. I have removed one foreign body from the stomach.

The diagnosis of the malignant cases was not made early, because the cases were brought to me late in the disease. When the gastroscope shall have reached its deserved recognition, these cases will be examined sufficiently early to give the abdominal surgeon a fair chance. Better still, a positive diagnosis of pre-cancerous conditions will be made sufficiently early to enable him to save lives that are now lost through reluctance of the patient to submit to an exploratory operation. I do not intend to advocate gastroscopy as a substitute for exploratory gastrotomy. There are, however, many patients who refuse to be explored surgically. If a patient is told that he has a cancer, usually he is willing to submit to an operation, which is often too late to help him. If we tell him a cancer or a pre-cancerous condition is suspected, and we wish to explore and see, only too often he declines in this early hopeful stage. But the proposal to insert a tube through the mouth for examination will be rarely refused. This I feel sure will enable in many instances needful early diagnosis. The vital importance of early diagnosis in malignant and pre-cancerous disease of the stomach renders every possible aid of greatest value. When the diagnosis is made from a palpable tumor, cachexia and the vomitus, it is useless, usually, except for prognosis.

In considering the possibilities of gastroscopy, the occurrence of tumors other than carcinomata and sarcomata must not be forgotten. The gastroscope renders it possible to take a specimen in cases of fibromata, myomata, lymphadenomata, etc. Of these, however, I can offer no reports of cases.

One of the limitations of gastroscopy at present is the limited value to be placed upon negative results. Any lesion, if it exist in the explorable area, can be seen and, if advisable, felt, with the probe, and its nature determined; but if no lesion be found, we cannot be certain that none exists in the unexplorable area. However, with greater skill I feel sure this unexplorable area will be diminished.

Instruments. The great difficulty to be overcome in the direct inspection of the stomach through the esophagus has

been the loss of light on account of the length of the tube required. This has been overcome, as in my bronchoscopes and esophagoscopes, by placing the lamp at the distal extremity of the tube where the light is needed. This not only prevents loss of light on account of the distance, but the even greater loss from a few drops of secretion or of a probe or forceps or any other substance in the tube, such substance cutting off so much of any light projected into the tube that nothing could be seen satisfactorily. With the light at the distal end the gastric mucosa is as clearly shown to view, at the end of the 80 c.m. tube, as is the laryngeal mucosa in the laryngoscope.

The diameter of the adult gastroscope is 9 m.m. and the length is 80 c.m. (Fig. 19). The general form of the tube

Fig. 19

and obturator is the same as the esophagoscopes and bronchoscopes that I devised some years ago. The distal end of the instrument is a thickened ring to prevent injury to the tissues. My attention has been called to the fact that through defective workmanship some of the bronchoscopes on the market, to which my name is attached, were made with a sharp angle at the ring, which made it difficult to avoid wounding the mucosa.

The gastroscope is fitted with an obturator or pilot which presents a conical tip beyond the tubal orifice, the conical end facilitating the introduction of the instrument into the introitus esophagi superioris, especially for those unfamiliar with the work. No graduations are marked upon the exterior of the tubes. They are not necessary and the roughness is a disadvantage. It is easy to measure with a sterile steel centimetre rule the distance between the upper teeth and the outer

end of the tube. Thus 80—7=73 centimetres below the upper
teeth.

The light is carried on a removable light-carrier which
passes through a small auxiliary tube made in the wall of the
main tube. The small lamp, when the carrier is in place, is
right at the distal end of the gastroscope where it brilliantly
illuminates the field, while it is itself out of the way of vision
and instrumentation. The light-carrier is attached to the cord
with a bayonet fitting which can be used to turn on and off
the current. The cord is covered with rubber, permitting alco-
holic sterilization.

Commercial lighting circuits should never be used for light-
ing the lamps. All rheostats have one live side which may be
"grounded" through the patient, involving great danger, even
if of no more than 110 volts pressure, on account of the good
contact with the moist mucosa, throughout the length of the
tube. Dry batteries involve no risk whatever and with intelli-
gent care are perfectly satisfactory.

In addition to the gastroscope the essentials are: A secre-
tion aspirator, cotton carriers, tube forceps, probe, extra lamps,
a mouth gag, a glass of sterile vaseline, sterile cotton and sterile
gauze strips, about 4x6 c.m. in size for use in the carriers.

The forceps are lengthened forms of the forceps devised
by me some years ago for bronchoscopic work. They have
the advantage that in working the tube is pushed over the
jaws, the jaws are not pulled into the tube. Thus the jaws
do not retreat from their bite and the strength of grip is really
astonishing.

Anesthesia. Cocain anesthesia in a courageous patient is
sufficient so far as the pain of examination is concerned, but
it does not stop the retching like deep general anesthesia.
Chloroform I consider dangerous for esophagoscopic, and es-
pecially for gastroscopic, though not for bronchoscopic work.
Deep anesthesia is absolutely necessary to prevent retching,
which is to be avoided while the tube is in the stomach, and
prolonged deep anesthesia is not safely maintainable with chlor-
oform. Ether, then, is the choice, preferably started with ni-
trous oxide.

Technic. There are two essentials that I desire to emphasize
at the outset. These two things are so commonly (I had al-
most said criminally) ignored that I cannot make the em-

phasis too strong. The first essential is asepsis. Of course absolute ideal asepsis is impossible, because the field cannot be sterilized, but oral antisepsis will help. The teeth should be put in good order by a dentist; they should be cleaned with a brush and thymol-menthol solution, followed by a carbolized mouth wash. The stomach is better not washed out except by the inpouring of its own secretions during the fasting period. The face and neck should be washed with soap and water, followed with bichlorid rinsing. The hair should be
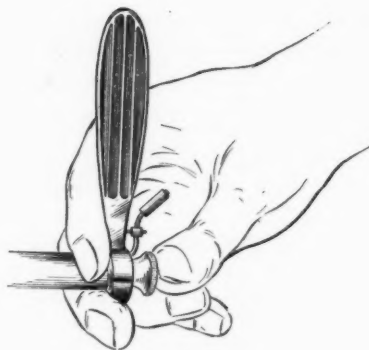
Fig. 18

covered with a sterile rubber cap. The instruments should be absolutely sterile. All the instruments can be boiled except the lamps and light carriers. These can be immersed in alcohol. The other essential is gentleness. Absolutely no force is to used. The utmost gentleness must be observed, lest abrasions of the esophagus be produced. Skill, not force, is required. Some operators who have used my esophagoscopes and bronchoscopes have asked why I did not have them made heavier and stiffer, with larger, stronger handles, etc. All this implies rougher handling than is necessary or justifiable. The two first fingers of the right hand are all that are necessary, assisted by the thumb, which holds the obturator in position (Fig. 18) and gently pushes the instrument inward when

the finger of the left hand has raised the cricoid cartilage and larynx upward (supine patient) away from the vertebra, thus opening the introitus esophagi superioris (Fig. 17). The end of the tube is guided along the finger, being careful not to gouge the posterior pharyngeal wall, which is rigid by reason of its being backed by the vertebræ. If the cricoid cannot be reached, lifting the epiglottis and tongue will serve.

A number of times I have seen men grasp the handle of the instrument like an L-shaped umbrella handle, ramming it down, and prying around in various directions, failing to enter the esophagus and gouging out long sections of mucosa from the posterior pharyngeal wall. Again I have seen the sinus pyriformis and the arytenoids rammed so that they ached for days. All this is wrong, and, to repeat, skill, not force, is
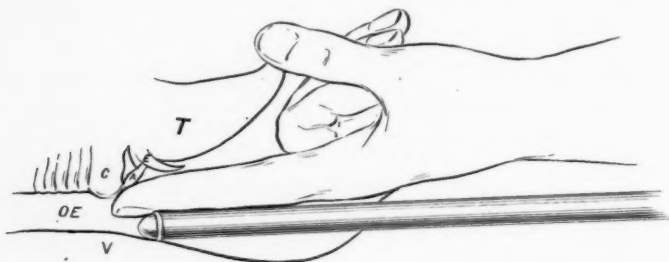
Fig. 17 (Diagrammatic).

required. If the esophagoscope is placed rightly, a gentle push with the thumb will cause it to enter the esophagus, when, if it has been well greased, it will slide down with the most gentle touch. A good set of upper teeth is somewhat in the way, but there is plenty of room at the side of the mouth, the head being inclined slightly toward the opposite (left) side if necessary. The head should hang over the table in Rosen's position, the patient being supine, and the operator standing at the head of the table looking toward the patient's feet. The table should be rather high, so that a slight incline, made by elevating the foot of the table, will not make the head too

low for comfortable work. This inclination favors the flow of secretions outward. The reverse position is useful.

Three points of obstruction may be noticed in the normal esophagus in some instances:

(1) At the entrance, behind the cricoid cartilage; (2) posterior to the bifurcation of the trachea, and (3) at the hiatus diaphragmatis. Occasionally an obstruction is met with at the cardia, not so much from constriction as because of the deviation of the esophagus to the left.

These all vary greatly in different individuals and may not be noticed at all. At the bifurcation of the trachea the impulse of the aorta is marked. At the diaphragm often there seems more of an obstruction than there really is, being accentuated by the curve of the esophagus at this point which allows the esophagus to come against the margin of the diaphragmatic hiatus. After the extremity of the gastroscope passes the introitus esophagi superioris, it is better to remove the obturator, and attach the cord by the bayonet fitting to the light-carrier, as the tube can be guided more gently by the eye which enables the following of the opening up of the tube ahead, especially when obstructions are met.

After the stomach is reached there are two plans of exploration, both of which should be carried out. First the gastroscope should be passed down carefully and gently to the greater curvature, inspecting the anterior and posterior walls. At times these walls do not seem to be fully collapsed ahead of the tube and one will have to be examined first, then the other. Then the tube is withdrawn, inclined slightly laterally in the same plane, then pushed gently downward again in a new series of folds.

After the whole possible range has been covered in this way, we proceed to the second plan. The tube is passed down until the extremity touches the wall of the greater curvature in the extreme left of the possible field. Then the tube is moved slowly along the greater curvature, but not in too close contact therewith, until the extreme right is reached. Withdrawing the tube a centimetre or two, the field is slowly swept again in the same plane, but at a higher level, and so on upward to the cardia. Next the deft fingers of one skilled in abdominal palpation is called upon to manipulate the unexplored portions over in front of the tube. This is sometimes better accom-

plished by turning the patient on his side, first on one, then on the other. During all these manipulations the tube must be withdrawn within the esophagus. When the stomach is in its new position the gastroscope is again pushed downward and the newly available surfaces are explored. Should retching supervene while the gastroscope is in the esophagus, no harm will result, but when the tube is in the stomach, retching is the signal for immediate withdrawal of the gastroscope until the distal end of the tube is above the diaphragm. The instrument should be greased with a gauze sponge dipped in vaseline. Gauze strips are best for cleaning the lumen of the tube when withdrawn.

Difficulties. So far as the passage of the instrument into the stomach is concerned, there is no difficulty to one accustomed to work in the throat, and to whose fingers every landmark is familiar. To one unaccustomed to work in this region, some difficulty may be experienced at first in entering the tube, even with its obturator, into the introitus esophagi superioris. A flow of fluid out through the tube causes delay rather than difficulty. The stomach seems never to be completely empty. There is always a pocket or fold to be found out of which some fluid will pour. This, if normal, readily flows away. Thick, viscid secretions, as in gastritis, may cause delay. It might seem easy to pump away all fluid, and if the stomach wall were like a hot water bag, this would be easily done. But in the nearly empty stomach there are wrinkles, folds, and pockets, only one or two of which can be emptied at a time. A diverticulum in one case was a source of some difficulty, its orifice being so much larger than that of the esophageal lumen below. Careful inspection and the wiping away of secretion with the gauze mop enabled the finding of the esophageal lumen below and the insertion of the gastroscope therein. It would have been impossible to have passed a bougie in the old way beyond this diverticulum. Cardiospasm in one case was a difficulty that was overcome by the use of the well-oiled obturator guided intelligently by the foreknowledge of direction gained by the previous inspection. Cardiospasm is prevented by profound general anesthesia, but this was not considered wise in the case mentioned.

Inaccessibility of some portions of the stomach, of greater degree in some patients than in others, and of greater degree

at some times than at others in the same patient, offers diffi-
culties. These may be overcome by the skilful but very gentle
manipulation of the tube combined with skilful and gentle
manipulation of the tumor or stomach on the abdominal wall
externally. The movability of the mass in some cases of gas-
tric cancer, especially in thin people, may permit a skilful
manipulator to bring what seems a very remote mass right
before the gastroscope. Sometimes the pylorus can be more
closely approached by turning the patient on the left side, at
other times turning has seemed to cause the pylorus to move
away. The exploration of the fundus in the adult is an im-
possibility with any instrument I have been able to devise,
though a good manipulator with hands on the abdominal wall
externally may assist the operator and with a very relaxed
abdominal wall or infantile form of stomach, much of the
fundus can be brought into view. The radiograph (Fig. 20)
by Dr. R. H. Boggs, shows the range of motion of the tube
without abdominal manipulation in a case of gastroptosis. The
patient took ether badly and was not fully relaxed. The rigid-
ity of the diaphragm seemed to interfere with the movement
of the tube. In flaccid elderly persons of spare build, more
than twice this range of motion is easily obtained. The head
and neck should be swayed sideways with the tube in the esoph-
agus, which will cause the distal extremity of the tube to move
in the opposite direction. The indistinct outline is due to the
radiograph being taken during ether anesthesia. Bismuth given
the patient failed to show. The range of mobility of the nor-
mal stomach is astonishing. The lower portion of many nor-
mal stomachs can be pushed into the pelvis.

The greater curvature for an extent of about 14 c. m. is
readily explored. The portion, if any, of the lesser curvature
which happens to be nearly vertical may be explored readily.
A considerable area of both the anterior and posterior walls
is readily examined without the aid of the hand of an assistant
externally upon the abdomen.

Dangers and Contra-indications. In a patient with a normal
esophagus and stomach the only dangers are those of general
anesthesia. If cocain be used there is no danger. In esopha-
geal ulceration, care should be taken and if deeply eroded the
gastroscope should not be allowed to pass lest the thin bed of
the ulcer be broken through, not by the instrument but by a

possible retching.   Doubtless if so thin as this, the ulcer would soon perforate anyway.

To bite out the edge of the ulcer is easy with the tube forceps shown in Fig. 19, which I have designed for tube work. It seems to me that the risk of perforation in non-malignant conditions is great.   In evidently malignant cases, where the infiltration is a protection, and especially in fungatng cases, the risk I am sure is slight.   Aneurism, if present, constitutes a danger that is almost prohibitive.   Grave heart lesions are a contra-indication, though the lessor or the well compensated lesions are not prohibitive, unless they be unsafe subjects for anesthesia.   The same may be said of other organic diseases.

The manipulations externally, so valuable in bringing various portions of the stomach in front of the tube for view, involve no risk whatever in a stomach whose walls are not weakened by disease.   In the ordinary inflammatory conditions no weakness exists, nor in most cases of malignant disease.   In ulcer, however, caution is necessary, though with due gentleness no ulcer floor will be perforated save that of one which must soon have perforated by erosion or by the normal spontaneous movements of the stomach, especially when containing food. Hemorrhage is a possibility only in diseased states of the stomach or esophagus.   A normal vessel cannot be ruptured by the skilful and gentle use of the gastroscope.   In the three cases of gastric ulcer and the two cases of gastric cancer diagnosticated gastroscopically, no hemorrhage followed.   There was no bleeding in any of the normal cases.   In cases with a history of recent hemorrhage, doubtless it would be wise not to pass the gastroscope until at least a month free from all signs of hemorrhage had elapsed.   Diseases of the esophagus as malignant diseases and ulcer constitute no danger, as after passing the level of the cricoid cartilage, the obturator is removed and the instrument passed by sight, so that due caution may be observed when disease of the esophagus comes into view.   Even without this it seems that skill should render it safe.   Such an accident as the forcing of an instrument through the bottom of a diverticulum, as has happened with a rubber stomach tube (with stilet), can be readily avoided. An affectation of roughness and brutality are often mistaken for courage by the "bold surgeon."   Gentleness and skill are needed and will avoid all dangers.   Over-extension of the

head, especially if the shoulders are dropped, endangers the
patulousness of the tracheal lumen. Considering the pro-
longed (and for a time harmless) sojourn in the human stom-
ach, of foreign bodies such as glass, open pocket knives, nails,
tacks, etc., swallowed by the insane, the intoxicated, and others,
it does not seem, theoretically, that any risk is incurred in
passing a tube into the healthy stomach.

Gastroscopic appearances. Orientation is not easy on ac-
count of the great variation in the size, position and shape of
the stomach. If the stomach in life were anything like the
classic illustrations in the anatomic works, orientation would
be easy. Landmarks are few. The passing of the cardia is
determined usually with certainty by the change in color of the
mucosa, and the encountering of the plicae mucosae. These
folds extend away from the orifice of the gastroscope in long
ridges which disappear in the depths beyond or diverge and
blend into other ridges. As the lower portions of the stomach
are penetrated, it is noted that these ridges have a trend rather
transversely than directly away from the visual axis. This
usually marks the approach to the greater curvature if the
stomach is in classic position. Often, however, the transverse
ridges are not encountered and the receding ridges are fol-
lowed for what seems to be an incredible distance. This usu-
ally indicates that the stomach is in a more or less vertical posi-
tion and in one such instance my instrument reached the py-
lorus.

In portions of the stomach only slight ridges or folds were
seen (Fig. 7), and at times an approach to flatness (Fig. 8)
was noted. Both of these were when the tube was pushed
firmly against the stomach wall. In general, however, the ap-
pearance of the normal mucosa is fairly well represented in
Figures 2 to 6 inclusive. The stomach mucosa is at times seen
to move even when the tube is held stationary. In danger-
ously deep anesthesia this movement is absent. In many cases
no movement could be detected unless retching was imminent.

As with examinations of mucous surfaces elsewhere, the ap-
pearance only is not reliable without the aid of the probe and
the cotton applicator. For instance, in Figs. 9 and 10 what
seemed like a pathologic mass capped by an ulcerated surface,
when wiped and probed proved to be simply a normal fold,
capped by a mass of secretion. This was a case of chronic gas-

tritis. Figure 10 shows the appearance where all the ridges in sight except one were wiped clean. The secretions of a stomach which has fasted for 18 hours are a rather thin fluid with very little viscidity, and of a transparent brownish or olive tint. It runs out of the tube in a stream at times.

The normal healthy stomach after 18 hours' fasting usually does not contain mucus in any quantity. In my examinations I did not find any tenacious mucus in a normal stomach. The mucus swallowed from the upper digestive tract and bronchi is usually in isolated clots and not adherent, while in the one case of chronic gastritis examined, the tenacious mucus was in close contact with the stomachal mucosa and was not readily wiped away.

The gastroscopic appearances offer an enormous field for study, of which great good will come.

Case I. *Ulcer of the lesser curvature. Diagnosis and cure with the aid of the gastroscope.* Mr. M., aet. 32. Referred to me for gastroscopy by Dr. H. Finkelpearl. Patient complained of dull, uneasy sensations over the abdomen after eating, followed an hour later by pain in the epigastrium. Upon passing the gastroscope I found, after a fifteen minute search, an ulcer upon the lesser curvature about 3 centimetres below the esophageal margin. The ulcer was on the crest of a ridge and could not be manipulated so as to come flatly before the tube by the gentle maneuvers which I deemed advisable. The ulcer is represented in figure 11 as seen on edge. The figure should be given a quarter turn against the hands of the clock, as should also figure 12. The yellow in the plate is too strong.

I made an application of a ten per cent argentic nitrate solution which was repeated a week later. Upon re-examination the ulcer was found cleaner with reddish granulations scattered upon its surface. The case was then treated by Dr. Finkelpearl by swallowed remedies in the usual way, and three weeks later it was well symptomatically, and the ulcer had healed, leaving a whitish scar (Fig. 12).

Case II. *Ulcer of the greater curvature. Cure. Gastroptosis diagnosticated gastroscopically.* Mr. M., aet., 32, had vague symptoms referable to the abdomen, worse after eating, sometimes slightly painful. He had a dread of cancer, upon which his mind dwelt. Ether being given by Dr. E. J. Thompson, I passed the gastroscope with the assistance of Dr. Ellen

J. Patterson, and found an ulcer upon the greater curvature, the ulcer being seen plainly by Drs. Patterson and Thompson. Passing on downward 76 centimetres of the tube passed below the upper teeth, and the pylorus was reached. It was at once apparent that this was a case of gastroptosis. It is the only instance in which I have been able to reach the pylorus. The radiograph (Fig. 16), taken by Dr. Russell H. Boggs, shows the gastroscope in postition, the distal end at the pylorus, which, in this patient, was located in the pelvis. The gastroscope can be forced to this depth by pushing the lower wall of the stomach downward, but no force was used in this case, and this was apparently the usual position of the pylorus. The lack of sharpness is due, not to the lack of skill on the part of Dr. Boggs, but to the respiratory movements. The patient being etherized, he could not hold his breath.

I made an application of argentic nitrate solution. The patient called upon me a month later and claimed to be relieved of all symptoms, felt as well as he ever did, and saw no reason why I should want to examine him again, so that I am unable to verify, as to the ulcer, his claim of cure. As to the gastroptosis, naturally, no change need be looked for.

Case III. *Ulcer of the cardia and posterior wall diagnosticated gastroscopically.* Mrs. Mary A., aet. 53. Brought by Dr. Andrew Hunter, who suspected a stomach lesion on account of epigastric pain, extending backward to a point between the shoulders, and of vomiting without nausea. Ether being administered by Dr. Helen F. Upham, we passed the gastroscope and located a slight resistance at the cardia, with an ulcer about a centimetre in diameter, immediately below it posteriorly. Upon entering the tube three centimetres further, another ulcerated area of greater width located to the right was seen plainly. The upper edge of the upper ulcer was readily made out; also the lower edge of the lower one, but the intervening edges could not be uncovered by very gentle manipulation, so that we were unable to determine whether there were really two ulcers or only two portions of one continuous lesion. There seemed to be cicatrices about the cardia which rendered the exposure of the ventricular mumucosa difficult.

This patient is still under internal treatment by Dr. Hunter, and is improving rapidly.

Case IV. *Malignant disease of the pylorus and greater curvature.* Charles K., aet. 44. Family history unknown, personal history negative, except as to alcoholism. Admitted to the Western Pennsylvania Hospital in the service of Dr. E. B. Haworth. Three months before patient had lost appetite, weight and strength. He complained of epigastric pain, burning in character, worse after eating, occasional vomiting, usually an hour or two after taking food, sometimes of coffee grounds character. A mass about the size of an orange could be palpated, and was thought to be at or near the pylorus.

At the request of Dr. Haworth I passed a gastroscope, under local anesthesia, and in a few minutes located an ulcerating fungoid mass on the greater curvature involving the anterior and posterior walls. The left edge could be followed for about 5 centimetres, and the mass could be explored toward the right for about three centimetres. Fig. 15 in the plate represents the appearance of the left edge rather imperfectly, owing to my lack of skill at color drawing. The image in the gastroscope, however, was just as plain as in the figure. The infiltration shown at the edge of the mass had obliterated the folds at that point.

To the touch of the tube as well as the probe, the mass was hard. Quite unlike the soft yielding of the normal stomach wall. The lesion was examined through the gastroscope by Drs. E. B. Haworth and C. H. Ingram. The patient refused to have a specimen taken for examination. He also declined operation and was discharged from the hospital.

Case V. *Epithelioma of the cardia and lower curvature.* Henry M., aet. 38, admitted to the Western Pennsylvania Hospital in the service of Dr. E. B. Haworth. Family history negative. Personal history negative except as to alcoholism. Six weeks before admssion first noticed pain in epigastrium and at back. Since has been losing weight and strength. Icteroid hue of skin first noticed two weeks before admission. Had vomited twice, and noticed "coffee ground" character each time. A tumor was palpable in the epigastrium about the middle line. Upon passing the gastroscope, the thoracic portion of the esophagus opened normally ahead of the tube, with the respiratory movements, as in Fig. 1 in the plate. When the cardia was reached the tube encountered

a hard resisting mass, as shown to the right in Fig. 13. To the left the tissues were normal and the gastroscope was gently insinuated in that diretcion, and it passed the obstruction read-ily. About two centimetres farther on, an exuberant nodular mass appeared in front of the tube to the right, and evi-dently was at the center of the hard mass encountered as the tube entered the stomach. The appearance is fairly well represented in Fig. 14. Beyond this mass was a gap, the bottom of which could not be explored. Beyond this gap the folds seemed normal in every direction. A specimen was taken with the tube forceps described above, and was re-ported upon by Joseph H. Barach as squamous celled epi-thelioma. Operation was refused, and the patient was dis-charged.

A diagnosis of malignancy was justifiable, I think, in both of these cases on the gastroscopic results alone, especially the fungating ulcers, the mass and the induration as de-termined by the touch of tube and probe. True, in these cases, a diagnosis could have been made, indeed, was made by Dr. Haworth, on the history, examination of the vomitus and palpation of the tumors, yet when the diagnostic possi-bilities of gastroscopy shall have been realized and early op-portunities afforded, a diagnosis will be made earlier than is possible by any method other than exploratory operation, consent to which frequently cannot be obtained until late.

Case VI. *Jaw of forceps removed from the stomach by gastroscope.* This is the only case in which I have had an opportunity for the removal of a foreign body from the stomach. While using the forceps as a cotton carrier for swab-bing the distal end of the gastroscope, one of the jaws of the forceps broke. The cotton was sufficiently entangled in the other jaw to come out with the forceps, but the detached jaw was scraped off by catching on the distal end of the gas-troscope.

Just then the patient, having come partially out from the anesthetic, retched a number of times, during which the ever-moving stomach wrinkled its folds and the jaw of the forceps was lost to view. To make matters worse, I had at hand no other forceps long enough to go through that tube (80 cm.), so I withdrew it. The fragment of forceps became thus, to all intents and purposes, a foreign body at large in the

stomach. While, in view of its small size, it did not seem a
serious matter should it not be found, yet, because of the
sharpness of one end, judging by the point of the fracture,
I felt that leaving it involved a certain degree of risk. I
then introduced a 70 cm. tube, for which I had forceps at
hand. Fully a half hour was consumed in exploring one
fold after another of the gastric walls before the foreign body
was finally found and removed. This accident need not have
occurred and will not occur with me again, as the forceps
were damaged for want of a carrying case and should not
have been used in their damaged state.

<div align="center">RESUME.</div>

1. *History.* The attempts made 25 years ago to examine
the stomach gastroscopically were abandoned because no prac-
tical instrument was devised.

2. *The instrument* herewith described renders gastroscopy
easy for any one accustomed to work in the esophagus. As
with my esophagoscope and bronchoscope, the light is at
the extremity of the tube, where its full power is available
without loss through distance.

3. *Usefulness.* Gastroscopy is not simply a feat. It has
a field of usefulness that will increase as our skill and knowl-
edge increase. Gastroscopy, in my opinion, is useful for the
detection and removal of foreign bodies, the diagnosis of
many pathologic conditions, as inflammation, ulceration, scars,
neoplasms, dilated vessels and the treatment of at least one
of these conditions, namely, benign ulcer. When the gastro-
scope shall have gained its deserved recognition, malignant
disease of the stomach will be diagnosticated in many in-
stances sufficiently early to give the abdominal surgeon a fair
chance. Better still, a positive diagnosis of precancerous con-
ditions will be made sufficiently early to enable him to save
lives that are now being lost through reluctance of the patient
to submit to an exploratory gastrotomy. Gastroscopy is not
offered as a substitute for an exploratory operation in every
instance. But only in those cases in which the patient de-
clines to submit, or in which the surgeon or the physician
considers a simple procedure almost free from risk prefera-
ble to operative exploration.

4. *Results.* With the gastroscope, I have made a diagnosis or gastritis, gastroptosis, malignant disease of the cardia and of the pylorus, each in one instance. I have made the diagnosis of peptic ulcer in three cases, one of which was cured by direct applications. I have removed one foreign body from the stomach, being a forceps jaw lost therein by myself.

5. *Limitations.* Negative results from gastroscopy are of limited value, because we cannot be certain that no lesion exsts in the unexplorable area. But with greater perfection and skill, this unexplorable area will be very much diminished.

6. *Anesthesia* by ether is preferable. Chloroform is unsafe, and cocain, though an adequate analgesic, does not stop the retching which will interrupt so constantly.

7. *The explorable area,* with a stomach of the classic shape and position, is the middle third. More than a third of the greater curvature is readily seen, likewise of the anterior and posterior walls at their inferior portions, the lateral extent of the field diminishing upward toward the esophageal orifice. The fundus and pyloric ends can be brought within range of the gastroscope by the external assistance of an expert abdominal manipulator, the tube being withdrawn within the esophagus, until the new field is in place. In vertical and gastroptotic stomachs, the lesser curvature, the pylorus and the pyloric third are readily explored with little or no external manipulation.

8. *Dangers.* In a patient with a normal esophagus and stomach, the only danger is that of ether anesthesia. An ulcer of the esophagus or stomach constitutes an exceedingly slight risk unless the ulcer bed be so thin that it would perforate within a few days by erosion or by the normal spontaneous movements of the stomach. In chronic inflammatory states of the stomach, no risks are incurred. In malignant disease a specimen may be taken with little risk in fungating conditions, but in flat ulcerations suspected of malignancy, the biting out of the edge of the ulcer, though very easy of accomplishment, is unjustifiable. The danger of hemorrhage is nil in the normal stomach; in the diseased stomach it exists only in cases which are about to bleed anyway.

The foregoing statement of dangers is based upon gentle manipulations, and the observance of certain rules, the most important of which is the immediate withdrawal of the gastroscope within the esophagus above the diaphragm, should retching supervene, waiting for the re-advent of deep anesthesia before again pushing the tube downward.
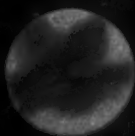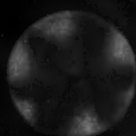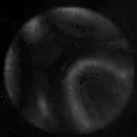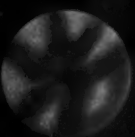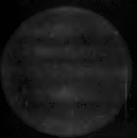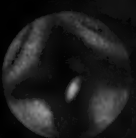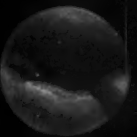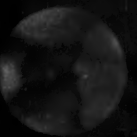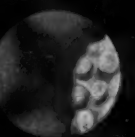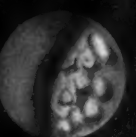
GASTROSCOPIC VIEWS
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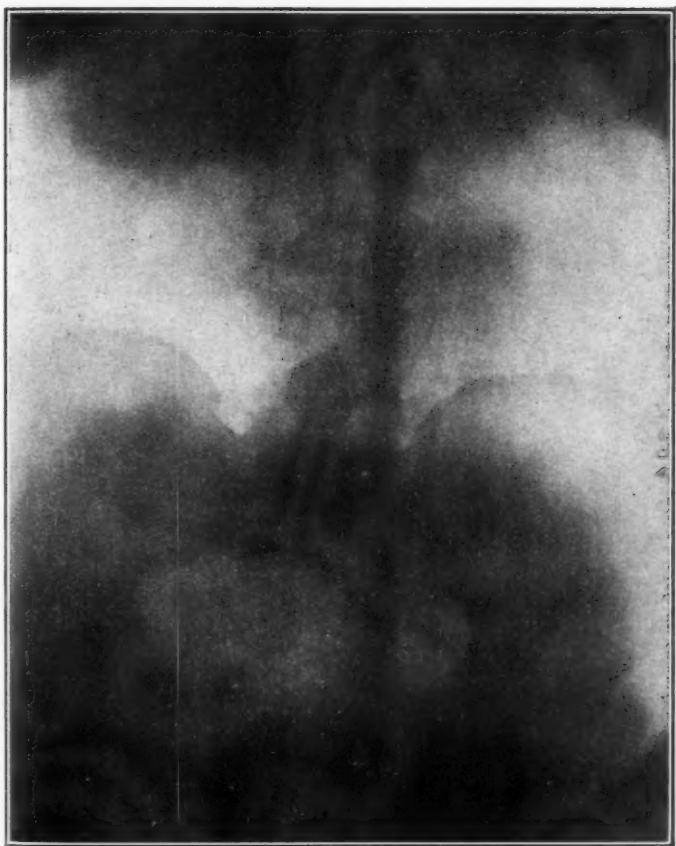
Fig. 16

Fig. 20
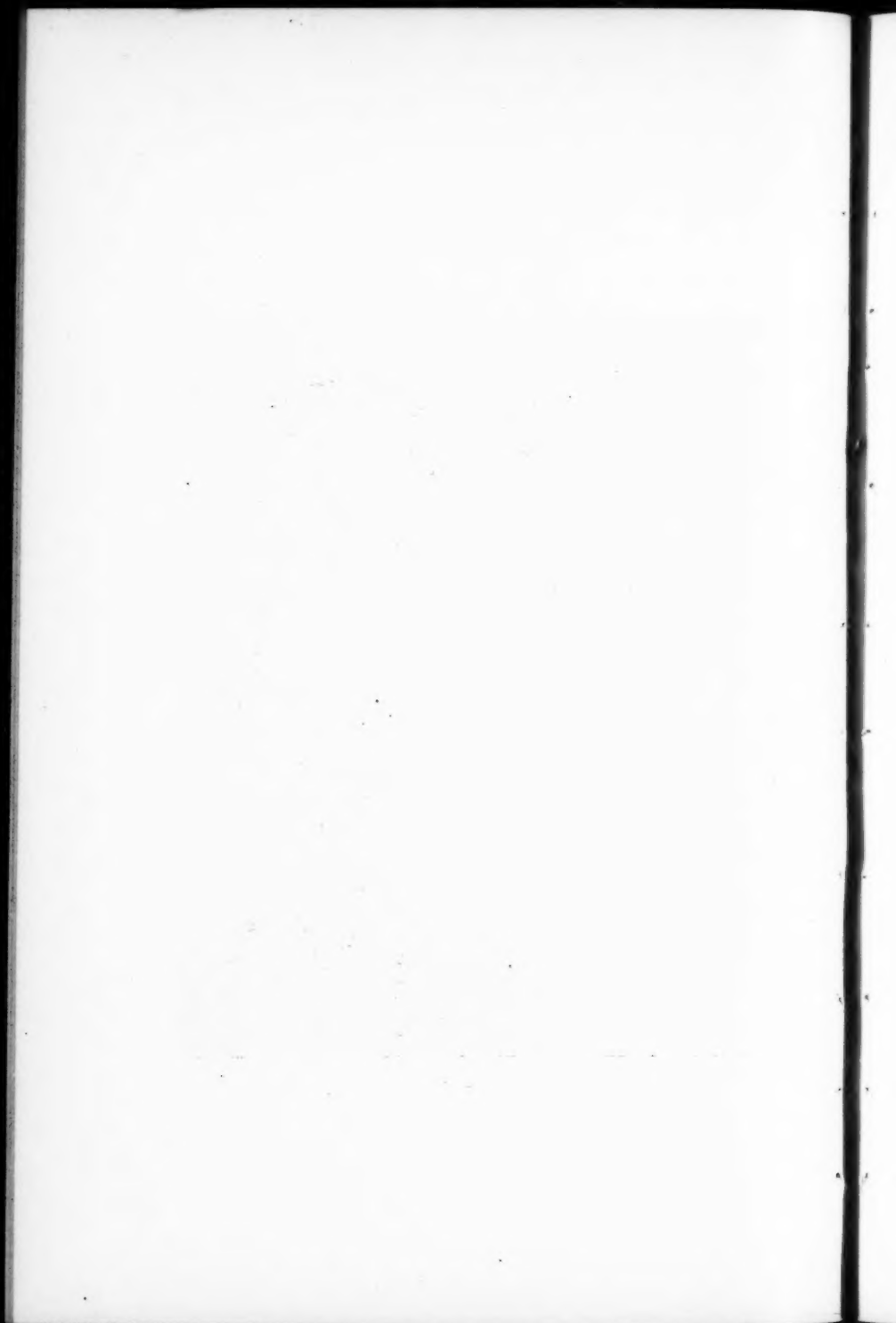
LVI.

CONGENITAL LARYNGEAL STRIDOR.

By A. Logan Turner, M. D., F. R. C. S. E., F. R. S. E.,

LECTURER ON DISEASES OF THE EAR, NOSE AND THROAT, EDIN-
BURGH SCHOOL OF MEDICINE,

EDINBURGH.

In discussing the subject of congenital laryngeal stridor, it is my intention to limit my remarks to a consideration of the different views that have been advanced regarding the etiology of the affection. Before doing so, however, it is very essential that we should have a definite conception of the clinical features presented by a typical case of congenital laryngeal stridor. A perusal of the literature of the subject reveals the fact that there is sometimes a misconception as to what really are the clinical phenomena of this condition, a misconception which must necessarily lead to some confusion in the study of its etiology.

The symptoms have been accurately described by John Thomson. The infant, who appears in other respects normal, is noticed shortly after birth to have noisy breathing. The noise consists of a croaking sound occupying inspiration, which assumes the character of a high-pitched crow when a more forcible inspiration is taken. Expiration may be accompanied by a short croak when the stridor is loud, but at other times it is noiseless. There are occasionally brief intervals during which no sound is audible even in very severe cases, but with this exception, the stridor goes on constantly while the child is awake, and sometimes even when he is asleep. Emotional excitement or any physical cause of deeper breathing, such as exposure to colder air, or the act of crying, may intensify the sound. The child's power of crying and coughing is unaffected. A feature of very considerable interest in the case is the fact that, although the breathing is noisy, it is not accompanied by the slightest distress, and there is no cyanosis. There is, however, marked inspiratory indraw-

ing of the thoracic and abdominal walls, except in the mildest cases.

The stridor increases in loudness during the first few months, and after remaining about the same for a few months more it gradually lessens and finally disappears during the course of the second year of life.

Various explanations have been offered to account for these clinical phenomena: thus we have a reflex laryngeal irritation induced by the presence of adenoids in the nasopharynx (Robertson, Eustace Smith); pressure upon the trachea from an enlarged thymus (Avellis, Hochsinger); congenital malformation of the upper aperture of the larynx (Lees, Sutherland and Lack, Refslund, Variot, Koplik); an ill coordinated spasmodic action of the respiratory muscles inducing an exaggeration of the normal infantile type of larynx, an acquired deformity (John Thomson and Logan Turner).

1. ADENOID VEGETATIONS. — Eustace Smith has described the origin of the condition to the presence of adenoids and the associated nasopharyngeal catarrh. "I attribute the stridor to a spasmodic contraction of the aryepiglottic folds, and believe that it is due to irritation set up by the adenoids in the nasopharynx." He points out that while the size of the post-nasal vegetations may be insignificant in any particular case, they may none the less be the cause of the symptoms, as the nervous irritation may be produced not so much by the adenoids themselves as by the associated nasopharyngeal secretion. To support his contention, Smith describes a case in which the symptoms were entirely relieved by the removal of the adenoids. The infant aged 1 month had had noisy breathing since birth, and at times the crowing was so loud and the breathing so labored and distressed as to raise fears of the child's life. Suffocative attacks of an alarming nature occurred from time to time, the lividity and distress being so great that immediate tracheotomy appeared imminent. On account of a suffocative attack of exceptional severity the child at the age of 3 months was admitted to hospital. The adenoid vegetations were removed, and in a very short time the noisy breathing ceased and there was no return of the threatened suffocation.

One is at once struck in the description of this case with the fact that the clinical picture differs in one very essential

feature from the classical cases of congenital stridor, namely, in the occurrence of severe attacks of dyspnea accompanied by cyanosis, and by the evident distress which the infant at times labored under. Suffocative attacks of this nature are extremely rare in connection with cases of congenital stridor, indeed with the exception of one of the fatal cases reported by Sutherland and Lack, we are not aware of any reported case of congenital stridor being accompanied by serious symptoms of this kind. That adenoid vegetations and their associated catarrh will produce attacks of difficulty in breathing, sometimes of an alarming nature, is quite well known, but such cases, to which that described by Smith corresponds, cannot be classified under the term congenital laryngeal stridor. Further, adenoids are very rarely met with in cases of congenital stridor, and when they are occasionally present their removal does not influence the character of the breathing.

In none of the cases examined by Sutherland and Lack were the tonsils much enlarged, nor were there adenoid vegetations of any importance. In none of them were the sypmtoms usually associated with such lymphoid hypertrophy present. Thomson did not find adenoids in his cases: in one of Variot's there was a small mass in the nasopharynx, but its removal made no difference in the stridor. In regard to only one of the eleven cases published by Massei, was the statement made that adenoids were present.

2. Compression of the Trachea by an Enlarged Gland.—In order to estimate what value can be attached to the views of Avellis and Hochsinger as to the origin of congenital stridor from compression of the trachea by the thymus, it is necessary to consider first, whether the trachea can be compressed by that gland, and, secondly, if such compression can be regarded as the causal factor in the production of the affection.

Both clinical and post-mortem evidence certainly appear to show that an enlarged thymus can compress the trachea and produce respiratory difficulty.

Clinical evidence is to be found in the small number of reported cases in which the respiratory embarrassment has been relieved by an operation upon the thymus. Thus Theodor, Siegel, Koenig, Perrucker, Moritz-Schmidt and Morse have

reported cases in which the thymus has been exposed and the gland either in whole or in part removed, or stitched to the periosteum covering the upper end of the sternum. In Theodor's case, the operation was performed by Ehrhardt; in Siegel's and Schmidt's cases, Rehn was the operator, and in the case reported by Morse, the operation was done by Murphy. I have not been able to find the report of more than seven cases operated upon. In six of them the operation proved successful, the difficulty in breathing being relieved. In Morse's cases in which the thymus was stitched, immediate relief was obtained but the symptoms recurred in a few days and the child gradually sank and died.

Post-mortem evidence of tracheal compression is also obtainable, but in selecting evidence of this kind I have been careful to cite only those cases in which it was distinctly stated that compression of the trachea was observed after death. This is very necessary for the reason that there are many cases in which at the autopsy the thymus is described as enlarged and death is believed to have been due to compression of the trachea without any actual evidence of the same. In Marfan's case, the trachea was found almost completely flattened by the hypertrophied thymus. Weigert also succeeded in demonstrating tracheal compression. In Massei's case a similar appearance was observed.

Sufficient evidence in support of the contention that the trachea may be compressed by an hypertrophied thymus has been recorded.

It is now necessary to determine whether such compression can be regarded as the etiologic factor in cases of congenital stridor. It is advisable at this point to quote briefly two of the cases of thymus compression, selecting one in which an operation was performed for the relief of the dyspnea, and one in which there was post-mortem evidence of compression.

Theodor's case, an example of the first, was that of a child aged 2 years, strong, pretty well nourished and with no evidence of rickets. For four months it had suffered from attacks of dyspnea, with cyanosis. The intervals between the attacks became shorter and the dyspnea increased in severity. It was accompanied by indrawing of the intercostal spaces and suprasternal notch—the stridor was present in both respiratory acts. Intubation failed to relieve the dis-

tress. The thymus was removed by Ehrhardt and there was no further respiratory difficulty. Massei's case was that of an infant 4 days old. There were sudden and violent attacks of dyspnea, bordering upon asphyxia: these followed each other at intervals, their duration being about five minutes. Cyanosis, turgescence of the veins of the neck and great distress were present. Death occurred after three days, and the autopsy revealed a very large thymus compressing the trachea.

It is at once evident that these cases present a very different clinical picture from that which we associate with congenital laryngeal stridor, so that it is difficult to believe that the same causal factor can be present in the two classes of cases.

It is necessary, therefore, to analyze the evidence brought forward by Avellis and Hochsinger in support of their contention. The cases described by the former in his paper correspond in every respect to the recognized clinical picture of congenital laryngeal stridor. Avellis argues that the approximation of the aryepiglottic folds in such cases is consequent upon a deeper lying stenosis, and is comparable to the tucking in of the alae nasi in cases of nasal or post-nasal obstruction. No clinical or post-mortem evidence is advanced by him to support this assumption. In his cases there are no attacks of dyspnea, no cyanosis and no real respiratory distress which form so essential a feature of the authentic cases of thymus compression of the trachea; in addition to the greater respiratory distress associated with thymus compression, the stridor is mainly of an expiratory type and the up and down movements of the larynx are restricted or absent when the trachea is stenosed. In Avellis' cases these features are not present.

Hochsinger, too, is of the opinion that the condition known as congenital stridor is due almost exclusively to compression of the trachea by an hypertrophied thymus, and that the stridor is produced in the trachea. He supports his contention by the aid of two clinical methods, radiography and percussion. Out of fifty-eight infants in whom a radiogram was taken, the thymus was regarded as hypertrophied in twenty-six. In twenty of the latter there were symptoms of congenital stridor. With our knowledge of the great variations both in the size and in the weight of the thymus, and our

knowledge of the fact that along with considerable hyper-
trophy of the gland, there may not be the least interference
with respiration, it would obviously be injudicious to attach
too much importance to the evidence furnished by the X-rays,
and by percussion.

Further, we have analyzed the notes of ten published fatal
cases of congenital stridor, and in only one of them, namely,
in Koplik's case, is the thymus stated to be enlarged, and
in it there was no evidence of tracheal compression. In five
of the cases the gland is described as not being hypertrophied,
while in the remaining four, no mention is made of its con-
dition. In the four latter, it is reasonable to suppose that
the gland presented no abnormal appearance. In typical cases
of congenital laryngeal stridor, therefore, there is no post-
mortem evidence that the thymus plays any part in the caus-
ation of the stridor. Uuntil more evidence can be brought
forward we are unable to accept the view of Avellis and
Hochsinger.

3. Congenital Malformation of the Upper Aperture
of the Larnyx.—Sutherland and Lack are of the opinion that
congenital laryngeal stridor is dependent upon two factors,
viz., a peculiar congenital malformation of the upper aper-
ture of the larynx and the flaccidity of the structures which
form that aperture. In six cases in which they made a laryn-
goscopic examination, the epiglottis was found sharply fold-
ed upon itself, its lateral margins being in close apposition
and in some cases in contact. The aryteno-epiglottidean
folds were approximated and thus the upper aperture of
the larynx was reduced to a small slit. The thin folds bound-
ing it seemed quite flaccid and flapped to and fro on respira-
tion. In only a few of the cases could a view of the vocal
cords be obtained. In one of their fatal cases the epiglottis
was soft and folded inwards, but no structural change could
be detected in the larynx on microscopic examination. While
a certain amount of deformity of the upper aperture is es-
sential for the production of the stridor, the valvular action
produced by the flaccidity of the soft parts forming its bound-
ary is also necessary to cause the obstruction.

The stridor is produced by the approximation of the ary-
epiglottic folds; as the respiratory column of air enters the
larynx, the folds already lying closer to each other than in the

normal infantile larynx, become approximated. The fact that
they are wider apart at the commencement of respiration but
become more closely approximated as the act progresses bears
out the observation that the stridor becomes higher pitched
at the end of respiration when the folds are nearer together.
Sutherland and Lack state further that as the child grows
the malformation remains, but the stridor passes off because
the parts forming the upper laryngeal aperture become less
yielding. They found the malformation persisting as long as
the cases remained under observation, in one case up to the age
of 6 years. Occasionally a similar malformation is met with
in advanced life, but they could bring forward no evidence
that such cases had suffered from stridor in infancy.

Other writers have expressed similar opinions with re-
gard to the pathology of congenital stridor. Lees depicts
the larynx of an infant aged 1 year, who had suffered from
stridor since birth and died from laryngeal diphtheria. The
deformity was of a very marked type. Refslund de-
scribes the larynx of infant aged 2½ months who had been
the subject of persistent crowing from birth. Death oc-
curred from pneumonia, and post-mortem examination showed
that the upper laryngeal aperture was reduced to a mere slit.
Variot's patient was a boy aged 1 year and 10 months, who
commenced to suffer from inspiratory stridor shortly after
birth. He died from scarlet fever, and the upper aperture of the
larynx showed a lesser degree of the deformity than that which
is figured in Refslund's case. Haushalter has published the
history of a child who died at the age of 8 months from
bronchopneumonia. Two days after birth, inspiratory stridor
was noticed. At the autopsy the upper laryngeal aperture
was considerably narrowed. The epiglottis was rolled back-
wards upon itself, its lateral borders being in contact. It
presented somewhat the appearance of a funnel, only a small
opening being left at the apex of the epiglottis. The aryepi-
glottic folds were also approximated and the arytenoid carti-
lages lay more closely together so that the interarytenoid
fold was effaced.

In Koplik's case, to which reference has already been made,
death took place at the age of 1 year from extensive broncho-
pneumonia. Symptoms of laryngeal stridor were first noticed
three weeks after birth. The upper laryngeal aperture showed
a well-marked example of deformity, the epiglottis being

curved backwards with its lateral borders almost in contact. The arytenoid cartilages and aryepiglottic folds were also approximated, the latter being thin and membranous, so that the upper aperture of the larynx was represented by a mere slit.

In all these cases presenting symptoms typical of the clinical picture of congenital laryngeal stridor, the appearance of the upper aperture of the larynx had been ascertained by post-mortem examination. Death occurred as a rule from intercurrent respiratory affection. In all of them a very similar and characteristic malformation varying only in degree was observed.

It is regarded by these observers as a congenital malformation. The clinical features present in all of them were typical of the classical picture of congenital stridor. The attacks of dyspnea and cyanosis which form so marked a feature in cases of compression by the thymus were not observed in these cases. In studying the illustrations of the larynx figured in the fatal cases of Lees, Refslund, Haushalter and Koplik, one cannot fail to be struck with the marked deformity of the larynx. It is difficult, indeed, to believe how respiration could have been carried on without any dyspnea or cyanosis accompanying it. They are drawings, however, and not photographs. In Variot's case which has been photographed, on the other hand, the deformity is not nearly so marked.

4. AN ACQUIRED DEFORMITY OF THE UPPER APERTURE OF THE LARYNX, THE RESULT OF A DISTURBANCE OF THE CO-ORDINATION OF THE RESPIRATORY MOVEMENTS.

John Thomson regards the primary element in the causation of congenital laryngeal stridor to be a disturbance of the co-ordination of the respiratory movements, probably due to some developmental backwardness of the cortical structures which control them. As a result of the ill co-ordinated and spasmodic nature of the breathing, a change takes place in the upper aperture of the larynx. There is a constantly recurring sucking in of the soft structures which form the aperture, so that an exaggeration of the normal infantile type results,

The Larynx in the Infant.

In order to make the above statement more clear, it is necessary to consider both the type of the larynx and the character of the respiration in infants.

For this purpose Thomson and the writer examined a number of larynges from still-born infants and from children up to the tenth year of life. Some of them were examined *in situ* by means of a dissection which exposed the larynx from behind, while the remaining larynges were studied after their removal from the body by the *post-mortem* method. Our attention was directed mainly to the upper aperture of the larynx. The structures forming the boundaries of this space, namely, the epiglottis in front, the tips of the arytenoid cartilages and the interarytenoid fold behind and the epiglottic fold laterally, were found to be much softer and more collapsible than they are in the adult. In addition to the evidence of this as furnished by the handling of the parts, it was observed that the upper aperture of the larynx of the still-born infant was relatively wider than that of the infant which had breathed. In the latter the space is narrower from side to side, owing to the folding backwards and inwards of the epiglottis with the consequent drawing together of the aryteno-epiglottidean folds. This is due to the soft collapsible character of these structures acted upon by the inspiratory air current. The form of aperture thus produced constitutes the infantile type of larynx, which has been described by Merkel, Luschka and other anatomists. As the child grows, a change takes place in the form of these parts, the epiglottis becomes more expanded, the aryepiglottic folds are separated and the upper aperture is in consequence broadened. At the age of $3\frac{1}{2}$ years the opening of the larynx is wider, while at 9 years of age the infantile type has almost entirely disappeared.

While varieties are met with in different infantile larynges, at the same period of life, all of them possess in a more or less marked degree the characteristics above described. These peculiarities combine to make the upper aperture of the larynx liable to changes in form under the action of influences which have no corresponding effect upon the adult organ. The most important influence of this kind is a sudden drawing of air into the larynx. In the larynges of the

new-born children and very young infants, the effect on the
larynx of drawing in air can be easily demonstrated after
death by a simple experiment. A bent metal tube is intro-
duced into the trachea, and in order to open up the chink
of the glottis a piece of rubber tubing is placed between the
vocal cords. Forcible inspirations are then made through
the tube, when it is found that with each, a striking altera-
tion in the form of the upper aperture of the larynx occurs.
The exact change varies in different cases, but the follow-
ing main types may be noted:

1. In some cases the lateral margins of the aperture be-
come sucked together so that merely a narrow mesial slit
is left between them.

2. In others the epiglottis is drawn backwards and down-
wards so as to act as a lid to the aperture.

3. In others again the arytenoid cartilages meet in the middle
line, the margins of the anterior part of the aperture remain-
ing unaffected.

When this experiment is repeated several times upon the
same larynx, one observes that the upper aperture retains
to a very considerable degree the deformity which the suc-
tion has produced. Thus, when the aryepiglottic folds are
drawn in so that a vertical mesial slit is left between them,
they are found after a few experiments to be permanently
nearer one another. We were further struck by the fact that
in some of the experiments the form assumed by the upper
laryngeal aperture closely resembled the deformity which has
been figured in the fatal cases described by Refslund, Thom-
son and others. In Thomson's case, an infant dying at the
age of three months, the epiglottis was folded back in such
a way that its lateral margins were in contact and the ary-
epiglottic folds approximated so that only a narrow slit was
left between them. In other words, the malformation which
has been regarded by some writers as a congenital one, can
be acquired by such a simple experiment as that just re-
ferred to.

The objection will doubtless be raised that such experi-
ments conducted upon the cadaver cannot be regarded as
entirely trustworthy, because the exact conditions which ex-
ist during life are not present. We would, however, again
emphasize the fact that the aryepiglottic folds which are
mainly concerned in the production of the deformity, con-

tain only a few muscular fibres, and are thin, lax folds of mucous membrane which are readily acted upon by such a mechanical force as the sucking in of air between them. Further, it is well known to all who have attempted to examine during life the larynx of healthy infants and young children, that the aryepiglottic folds tend to become approximated when the child forcibly inspires during the examination—that is to say, that the structures can assume in the living body the same position that they can be made to take up in the cadaver and as a result of a similar cause.

RESPIRATION IN THE INFANT.

In very young children the respiration under normal conditions is peculiar in being irregular in rhythm and in force, as if the co-ordination involved in its movements were not as yet under full control. There often occur, therefore, relatively sudden respiratory efforts. When a young baby is excited, it is no uncommon thing for it to develop a temporary crowing noise with inspiration, although it has none at other times. A similar but louder and more persistent crowing, which exactly resembles that in a case of infantile stridor, is not infrequently observed in young infants while they are beginning to come out of chloroform narcosis, and a similar loud crowing is a not uncommon accompaniment of operations on the genital organs, owing to the sudden forcible inspiration which the stimulation of the nerves of these parts brings about. Along with the crowing there is always a degree of indrawing of the lower chest wall proportionate to the loudness of the crow.

It is evident, therefore, that in infants in whom the respiratory conditions are normal under ordinary circumstances, there may be produced by any cause which will bring about a sudden and increased inspiratory effort, a crowing respiration similar to that which is observed in cases of congenital laryngeal stridor. This is due to the soft, collapsible nature of the structures forming the boundaries of the upper aperture of the infantile larynx. In the typical stridor cases, owing to the ill-conditioned and spasmodic character of the breathing, which forms the primary element of disturbance in these cases, there is also produced a narrowing of the upper laryngeal aperture and a consequent more or less

constant condition of stridulous breathing, the same as oc-
curs temporarily in normal children. We believe that the
sound is produced mainly at the abnormally approximated
aryepiglottic folds. The inspiratory croaking and crowing
sounds vary in loudness according to the vigor of the in-
spiration. It is never constantly present, there being always
occasional free intervals.

There appears to be sufficient anatomical, clinical and ex-
perimental evidence, therefore, in favor of the view that an
acquired deformity of the upper laryngeal aperture, the re-
sult of an ill co-ordinated type of respiration, is probably the
cause of the condition known as congenital laryngeal stridor.

LVII.

CHANNELS OF INFECTION IN TUBERCULOSIS.

By J. W. Gleitsmann, M. D.,

PROFESSOR EMERITUS, NEW YORK POLYCLINIC,

NEW YORK.

The subject under consideration is of such magnitude, that it is impossible to give a complete review, and many important points can be alluded to only briefly. Therefore it was necessary to refrain from treating of the infections of the skin, of the large visceral glands, the bones, the nerves and the uropoetic system, and to confine myself to the respiratory and digestive organs.

Before entering into the subject, a few remarks will not be amiss, which, although containing no new data, contribute to a better conception of infection in general, and allow of a shorter discourse of the separate chapters.

We distinguish the human, bovine and avian bacillus, but cannot enter into their differentiation, beyond stating that the cultures of the avian bacillus require 103° F., those of the human and bovine bacillus 98°. Of the animals generally used for inoculation, the rabbit is very slightly susceptible to the human, decidedly so for the avian and still more for the bovine bacillus. The guinea pig is highly susceptible for the human and bovine, but not for the avian bacillus. The virulence of the bacillus is enhanced by repeated transmissions through the susceptible animal, but diminished by successive cultures upon glycerin-bouillon.

The existence of the bacillus, only, is not sufficient for the diagnosis of tuberculosis; in addition, the presence of morphologic changes which demonstrate its pathogenic effect is necessary. Further, we must always keep in mind that the tubercle bacillus can not only enter, but also pass through the microscopically intact mucous membrane, without leaving a trace at the point of entrance. They become then localized in the mucous membrane or more frequently in a neighboring lymphatic gland, for instance, in a mesenteric gland in intestinal infection, and in case of calcification and encapsulation

remain innocuous indefinitely. But when caseation and disintegration take place and the bacilli enter the lymphatic system, they can settle in any organ and produce tuberculosis. This peculiarity of the tubercle bacillus renders the determination of the primary lesion often difficult for the pathologist even in initial cases, and is also partly the cause of the diversity of opinions of the investigators as to the channels themselves and the frequency of the different types of infection.

Two other topics, about which the authors are at variance, are the duration of latency of the tubercle bacillus in the human body till tuberculosis develops, and the relation of the human and bovine bacillus. Robert Koch, in his wellknown address at the British Tuberculosis Congress in London, 1901, pointed out the pathogenic difference between the human and bovine bacillus and the non-susceptibility of cattle to the former. His assertion was based on many experiments, viz., several animals received injections of tubercle bacilli under the skin, into the abdominal cavity, into the jugular vein, six were fed with bacillar sputum during seven to eight months, four animals inhaled large quantities of bacilli suspended in water. None of the nineteen cattle became diseased, they gained in weight, and when killed after six to eight months, no trace of tuberculosis was found in the internal organs; only small abscesses containing a few tubercle bacilli had formed at the point of injection. The reverse experiment on man being excluded, and having only once been made in Koenigsberg, with negative results, more than twenty years ago in six incurable cases of carcinoma (Baumgarten), Koch reasons, that primary intestinal tuberculosis from ingestion would be more frequent in view of the large quantities of milk and butter consumed, which very often contain living bacilli of pearl disease if the bovine bacillus was harmful to man. But Baginsky never found intestinal tuberculosis without such of the lungs and bronchial glands in 933 post-mortems of tuberculous children, and Biedert only sixteen cases of primary intestinal tuberculosis in 3104 post-mortems. If, therefore, a susceptibility of man for the bovine bacillus exists at all, Koch concludes that the danger of infection from milk and butter, etc., is very small, but at the same time recommends repetitions of his experiments, which were made by several investigators and with varying results. Not being able to enter into details we men-

tion only, that in quite a number of instances the transmission of tuberculosis to cattle by the human bacillus was successful, although other authors did not consider these experiments free from error; for instance, on account of intraperitoneal or intravenous injections.

The results of the extensive experiments of the German Imperial Health Bureau, which were also used as an argument against Koch, were analyzed recently by Weber in an article in the text book of the pathogenic microorganisms. He states, that inoculations of cattle with human bacillus produced infection near the point of injection, the shoulder gland, which sometimes became as large as a goose egg, but that the human bacilli did not progress any further, and that the gland entered retrograde metamorphosis after a few months. Inoculations with bovine bacillus were followed by continuous dissemination, leading to progressive tuberculosis.

In a later paper (*Brit. Med. Jour.*, December 20, 1902), Koch enumerates additional data in support of his views, and analyzes and refutes the validity of the cases reported by his opponents. He explains the great difference in the frequency of primary intestinal tuberculosis, found by various authors, by the difference of subjective opinion as to what is understood by this infection. He draws attention to the observation, that when a case of tuberculosis has occurred in a family or locality, where milk of a diseased cow has been used, other members of the family or group of persons would necessarily also have become infected, whilst the instances mentioned by authors are confined to isolated cases, and the other persons subject to the same infection remained well.

The assumption seems at least feasible, that the final results of future experimentation will show, that the human bacillus produces in cattle localized tuberculosis, not becoming a general infection, and that the same modus will hold good in reverse order for the human race. But till this important question has been definitely settled, the continuation of prophylactic measures, viz., boiling of milk, supervision of cattle, has to be recommended.

Before concluding these general remarks, the relation of tuberculosis to the consumption of milk, the mortality at different ages, hereditary, should be briefly considered. The

mortality in tuberculosis in Sweden and Norway, where almost all mothers nurse their children, is greater than in Germany. It is also high in Havana, China, the Philippines, in which countries very little milk is consumed. The same condition prevails in Japan, where, according to Kitasato, the proportion of cows to population is 5 to 10,000, and where the higher classes do not drink milk. How easily erroneous deductions are sometimes drawn from insufficient observations, is shown by the often cited case of Ollivier, in support of milk infection, which was reported in the Bulletin of the Paris Academy of Medicine in 1891. In a boarding school thirteen girls acquired tuberculosis within four years, and six of them died. The cow belonging to the school, when killed, showed extensive tuberculosis, from which a milk infection seemed evident. But on further investigation it was proven that the milk had always been boiled, had been used in small quantities only or not at all by the girls but principally by the teachers and servants, who all remained well. One of the thirteen girls could not have been affected by the milk, as she had left the school before the cow was purchased.

Naegeli (*Virchow's Archiv.*, Vol. 160) made eighty-eight post-mortems of children from 1 to 18 years and of 420 adults in search of the presence of tuberculosis, and states the pathologic conditions justifying him to assume its existence. He found fifteen tuberculous changes or 17 per cent in the eighty-eight children, of which fifteen cases only five had been diagnosed in life. In twelve new-born and those having died within the first year, no tuberculosis could be detected. Of the 420 post-mortems of adults, only the later, second series of 284 was considered, having been more carefully executed. Only six of the whole number were found without tuberculous foci, and in sixty-three cases the disease had been fatal. Naegeli's statistics, which had also been accepted by other authors on account of their accuracy, show not only the preponderant mortality after the seventeenth year, but also that at one time of his life almost everybody had a tuberculous lesion.

Naegeli's figures are confirmed according to a quotation of Behring (*Deut. med. Wochenschrift*, No. 39, 1903) by the investigation of the Austrian army surgeon, Franz. He made tuberculin injections into the soldiers of two regiments,

using the small dose of 3 mgr. to prevent ill sequelae, and 5 mgr. if repetition was necessary. He found in the regiment of soldiers serving their first year 61 per cent, of those in the second year of service 68 per cent reaction.

The statistics of the twenty-one authors quoted in Cornet's handbook, "Die Tuberculose," who believed phthisis to be hereditary, vary between 10 and 85 per cent. This great discrepancy is due to the elastic personal conception of heredity and cannot withstand scientific criticism. It is unnecessary to mention the change of views during the last decades, and two considerations will suffice for our purpose. Kuthri investigated the ratio of presence of tuberculosis in parents of tuberculous and non-tuberculous children. In the former, tuberculosis of the father was present in 10.5 per cent, of the mother in 9.9 per cent, of both parents in 2.1 per cent; in the latter, with non-tuberculous progeny, the father showed 9.2, the mother 9.2, and both parents 1.0 per cent; therefore, the greatest difference was 1.4 per cent when both parents had tuberculosis. Further, all cases must be disregarded in which the parents were in good health at the time of generation and birth of child, and became diseased ten to twenty years later, possibly due to infection from the child. The consensus of the opinion at the present time will approve the deduction of Cornet, when he says that heredity cannot be considered an important factor in the development and dissemination of tuberculosis.

Each classification of the channels of infection has the drawback, that some chapters touch upon the same ground and overlap each other. The most scientific division would be into primary and secondary infection, which necessitates a twofold analysis of each type of infection. If arranged by organs, repetitions can also not be avoided, and I thought an arrangement upon the clinical basis to be most suited for practical requirements. The subject is, therefore, divided into infection by inhalation, by ingestion, and into lymphatic and hematogenous infection. After these lengthy introductory remarks, reflections intrinsic to each type can be avoided.

I. INFECTION BY INHALATION.

The difference of opinions of authors mentioned above are nowhere more apparent than in the present chapter, as some

do not consider inhalation a source of infection at all, or in rare instances only, others as the most frequent cause. The reasons for these different views are most likely the various opinions that infection can be accepted as caused by inhalation. When the unimpeachable proof, according to Orth, that tuberculosis in man originates by inhalation of bacilli is demanded, it is impossible in the established disease to ascertain how the process has developed. But Orth also concedes the possibility, that repeatedly inhaled bacilli can penetrate the lungs, even alveoli, in spite of the natural protection by the ciliary epithelium, the discharge of the mucous membranes. Birsch-Hirschfeld, Cornet, A. Fraenkel, Lubarsch, believe in direct infection from inhalation. But we will not be amiss when using the term "inhalation" in a broader sense, and extend it to infections caused by inhaled bacilli, although we must concede, that in most cases the initial lesion does not occur at the place of entry, but in some part of the lymphatic system, as we have as an example tuberculous children, whose bronchial glands are frequently affected without lesion of the lungs.

Although we cannot enter into the different types of infection, we must mention the infection by impalpable sputum, so frequently mentioned in recent years. As to the individual organs, the infection of the nose must not be overlooked, which is produced by the contact with the fingernails, as they often contain bacilli in already diseased persons. But it is a well-known fact, that the infections occur the more frequently, the farther away from the beginning of the respiratory tract they take place. The nose enjoys special protection by its well developed ciliary epithelium, its easily excited reflex, its mucus inimical to bacterial life. The meninges can be invaded by communicating lymphatic vessels of the nose. The infections of the pharyngeal tonsils have received so much attention recently, that their knowledge will be familiar to all of us, a difference of opinion only existing as to their frequency. The faucil tonsils will be considered in the next chapter.

II. Infection by Ingestion.

The observation stated in the beginning, that tubercle bacilli may produce tuberculosis in other organs without leaving a trace at their point of entrance, is more frequently made in

infection by ingestion than otherwise. To corroborate this statement, and to establish the true path of the infection under natural conditions, Weleminsky (*Berl. klin. Wochenschrift*, No. 37, 1903) fed seven rabbits and seven guinea pigs from eight to twenty days with cultures of human bacilli of moderate virulence, and killed the animals in the interval of twenty to eighty days. Three of the seven rabbits remained well, one showed infection of the intestinal and respiratory tract, three of the latter only, and none of the intestinal. The guinea pig, being so susceptible to the human tubercle bacilli, is put by Weleminsky on a parallel with the vulnerable intestines of children, and he found, in every animal, disease of the intestinal and respiratory tract. But the stage of the diseased foci, which always showed infection of the submaxillary glands, and a more progressive stage in three animals, proved the primary and independent infection of the respiratory tract.

Several authors published primary infections of the pharynx, also of the esophagus, amongst them the writer of a very severe case of primary pharyngeal and laryngeal tuberculosis, which never presented tuberculosis of the lungs or other organs and remains cured now after sixteen years. But the infection of these parts is in the majority of cases of a secondary nature. The faucial tonsils and especially their crypts are not only a frequent portal of entrance of the bacillus, without necessarily becoming primarily diseased, but they are also exposed to infection from the coughed-up bacillary sputum. Primary intestinal tuberculosis has already been mentioned, but the opinions differ as to its frequency.

A new and unique type of infection has been promulgated by Behring at the meeting of the natural scientists at Cassel, 1903, and enlarged upon in the Berlin Medical Society, 1904. Briefly stated, he believes that the milk of the infant is the main source of infection, that the infection therefore results, in the infantile period, in the intestinal tract from the bacilli of the cow's milk, which bacilli remain latent for years in the lymphatic vessels and glands, till they finally enter the lungs through the blood. This opinion is so new and heterogeneous to the views hitherto accepted, that even one of his adherents finds it opportune to explain possible erroneous conceptions. He says, that Behring did not assert that the infantile infection was due only to bacillar food from the

cow, as the bacillus could easily be carried into the milk in dwellings of tuberculous patients (a source of infection known long ago). He further did not consider the infantile infection as the only cause of a later tuberculosis, but it predisposes to the latter. As the present paper is not intended to be a critic, but a resume of the opinions held at the present time, only a few adverse opinions will be quoted. B. Fraenkel said in the discussion following the Berlin essay of Behring, that although pulmonary tuberculosis can follow an intestinal infection, the tubercle bacilli generally leave traces before reaching the thoracic duct, and that nevertheless the mesenteric glands show less frequently tuberculous deposits in children than those of the chest and neck. He adds that Behring's opinion diverted us from approved methods of prophylaxis. Baginsky said that children predisposed to tuberculosis die of the disease in their infantile period in rare instances, and if so, we find seldom infection of the mesenteric, but without exception such of the bronchial glands. A few of the arguments of Behring's opponents, who seem to outnumber his adherents, are: the at least doubtful nature of the pathogenic effect of the bovine bacillus on man according to Koch, the probabilities of other paths of infection as proven by many observers, the assumption, incompatible with our present views, of the necessary latency of the bacillus, extending in some cases from fifteen to twenty years up to the outbreak of the disease.

III. Lymphatic Infection.

The important and prominent part, which is assigned to the lymphatic vessels and glands in infection, has been sufficiently emphasized in the two preceding chapters, to obviate the necessity of entering into details. But it may be in place to relate the lucid description of Cornet in his book cited above, how the bronchial glands become primarily infected. He shows the process by the example of inhalation of coal dust, the largest quantity of which will first be deposited in the upper air passages, less in the lower ones and least of it in the lungs. After a few hours or days the upper parts become free in consequence of the ciliary epithelium and the secretory current, whilst the lower remnant is still present and remains, if not transmitted to the bronchial glands by

the lymphatic vessels. The aveoli, devoid of ciliary epithelium, are being relieved of the coal particles through the lymphatic vessels in the direction of the bronchial glands, which become filled with the coal dust. A rare channel in intestinal infection is through the mesenteric, respectively retroperitoneal glands, which latter communicate with the bronchial glands through the superficial glands, emptying into the deep cervical ones. The lymphatic path, which the bacilli follow at infection of the faucial tonsils, has received the attention of many authors during recent years.

IV. Hematogenous Infection.

A true, primary hematogenous infection occurs only in utero in consequence of the placental transit of tubercle bacilli to the fetus, and the first authenticated case is described by Schmorl and Birsch-Hirschfeld in "Ziegler's Beitraege zur pathologischen Anatomie, 1891." Such infections are very rare, and up to 1905 only twelve positive cases have been published. But Schmorl found at post-mortems line time tuberculous foci in twenty placentas of tuberculous women, or 45 per cent.

A secondary hematogenous infection takes place, when a tuberculous deposit, for instance in a gland, breaks down, and its contents are carried into the blood vessels. An exquisite example is the acute miliary tuberculosis. Hematogenous infections of the lungs of a milder, less extended character can be caused by transmission of tuberculous foci of the walls of the blood vessels or of remoter organs. Tuberculous affections of the large visceral glands, of the spleen, liver, kidney, of the bones, joints, thyroid gland and peritoneum, are principally based on hematogenous infection.

If I now conclude this condensed review, I am well aware that in many instances I had to confine myself to a mere allusion to interesting features, in order to be able to give a resume of a subject of such vast extent and importance.

LVIII.

SARCOMA OF THE NOSE, WITH A CONSIDERA-
TION OF THE SPONTANEOUS DISAPPEAR-
ANCE OF MALIGNANT GROWTHS.

By ROBERT LEVY, M. D.,

PROFESSOR OF RHINOLOGY AND LARYNGOLOGY, DENVER AND
GROSS COLLEGE OF MEDICINE,

DENVER.

On the 15th of November, 1903, Mrs. C., aged 73, mother of a physician, was first examined by me for the purpose of determing what, if anything, could be done to relieve her. She gave the following history:

About March, 1903, symptoms of what appeared to the patient to be a cold presented themselves. There were slight discharge and some difficulty in breathing, particularly through the right nostril. There was no pain and no bleeding from the nose, the discharge being of a muco-purulent character; at no time during the history of the case was there any nasal hemorrhage. The difficulty in breathing became more marked in April and was complete about August 1st, 1903, compelling the patient to breath through the mouth. A mass completely filling the right nostril was discovered by the patient's son, and a small piece removed and submitted for microscopic examination to Dr. W. C. Mitchell of the Denver and Gross College of Medicine, who reported June 2nd as follows:

"In reference to the examination of nasal tumor for Mrs. C., I beg to report as follows: The entire mass consists of small, round cells with little if any basement membrane discernible. Histologic diagnosis, small, round-celled sarcoma.

Yours respectfully,

W. C. MITCHELL."

June 2nd, 1903.
(See Fig. 1.)
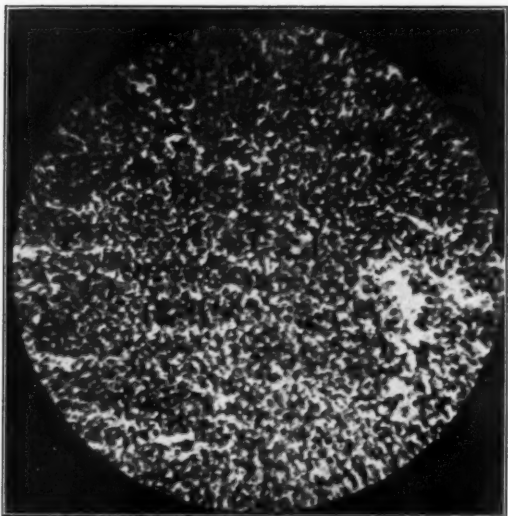
Fig. 1.

A number of physicians being consulted, the case was pronounced inoperable and the patient placed upon a course of iodid of potassium continued over a period of two months. The result of this treatment was negative. From August 8th until September 4th, the patient was given Coley's erysipelas toxins, the result being also negative.

My examination revealed a large, pale, nodular tumor filling the entire right nasal fossa, deforming the nose so that it was enlarged and flattened and deflecting the septum markedly to the left. The tumor extended from the anterior to the posterior naris. There was no ulcerated surface to be seen and no evidence of hemorrhage. The left tonsil seemed to be entirely free from involvement, being, however, decidedly narrowed by the deflected septum. An unfavorable prognosis was given, especially in view of the very positive microscopic report and a radical operation suggested as the only resort.

Upon consultation with Dr. Freeman, it was decided that the case was entirely too discouraging to warrant surgical interference.

On December 2nd the patient again presented herself, begging for at least some relief. I decided to remove enough of the growth by the intranasal route to relieve at least slightly and temporarily, the nasal stenosis. The operation was performed in two sittings. December 22nd and 29th, by means of cold wire snare, galvano-cautery snare, scissors and forceps. The bleeding was profuse, but the tumor was found to be less adherent than anticipated, and the right tonsil was thoroughly cleared of all suspicious tissue. Several days later the galvano-cautery was freely applied to the small projecting nodules in the roof and external wall of the nose. The patient now improved rapidly in general health, appearing finally well. Nasal respiration was free upon both sides, notwithstanding the deflected septum.

March 15th, 1904, there developed slight difficulty in breathing upon the left side of the nose. An examination revealed a small growth about the size and shape of a shelled almond situated upon the left side of the septum high up and in its anterior portion. There also developed about the same time metastatic growths upon both legs. On the right, there was one on the anterior and external surface below the knee, one on the anterior internal surface in the lower third of the leg and two in the middle of the calf. On the left leg, there was one in the middle of the calf. These growths were purple in color, smooth, shiny, firm and round. From March 15th until May 25th, X-ray treatment by Dr. Stover was conscientiously carried out, but resulted in no apparent improvement. The almond-shaped growth in the nose was then removed by scissors and knife and its surface thoroughly cauterized with the galvano-cautery, which procedure was repeated June 8th.

The secondary growth was again referred to Dr. Mitchell, who reported as follows:

" In reference to this examination of the nasal tumor of Mrs. C., I have to report the structure shows the identical cellular elements as the first mass, with the exception of numerous blood vessels. No signs of breaking down." (See Fig. 2.)
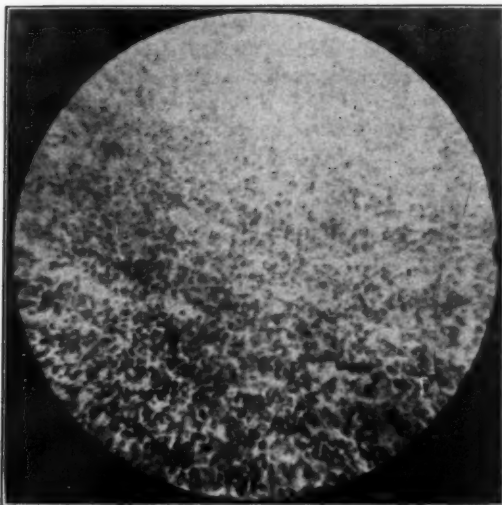
Fig. 2.

The nasal symptoms now continued to increase in severity, the stenosis became more marked and the nose swelled appreciably. Despairing of accomplishing anything further, the doctor was advised to make his mother as comfortable as possible and patiently await the final, fatal termination.

The patient was not again seen by me until April 12th, 1905, almost a year after the last operation. At this time the following remarkable condition was found: Absolute and complete disappearance of all evidence of nasal trouble, free breathing and no sign of a growth. A cicatrix was seen in the left nasal cavity at the site of former cauterizations, and a synechia extended from the septum to the roof of the nose. All but two of the growths upon the legs had disappeared, leaving a shiny, brownish discoloration. The two remaining were on each calf and were growing steadily, the one on the left calf measuring two inches and the one on the right one and one-half inches in diameter. In addition to this a small nodule had made its appearance upon the inner surface of the right leg, somewhat below the middle. This

nodule was about the size of a small almond, the skin over it being as yet not discolored. Upon inquiry it was found that the patient had received absolutely no medical attention. The disappearance of the growths had been entirely spontaneous. The diagnosis was now seriously questioned. Having learned several weeks before this examination of the progress the patient was making, a critical investigation into the diagnosis was instituted. The specimens were sent to Professor Welch at Johns Hopkins, whose report in full is here appended:

"JOHNS HOPKINS UNIVERSITY,

Baltimore, March 13th, 1905.

"Examination of specimens from nose for Dr. Robert Levy.

The specimen consists of several good-sized pieces of solid tissue, two or more centimetres in diameter, of irregular shape, but often uniform. The microscopic sections show in places over the rounded surface epithelium, partly cylindrical and ciliated, partly squamous, like that of the nasal mucous membrane, but more commonly this free surface is ulcerated and presents a necrotic, fibrinoid aspect.

The rest of the sections consist entirely of tumor, which is composed almost wholly of cells with scanty basement substance.

The cells are of the type of those of a small or medium-sized, round-celled sarcoma. Their nuclei are round or slightly oval, with distinct nuclear membrane and one or more nucleoli, or nucleolar-like bodies. Broken bits of chromatin or an imperfect chromatin-reticulum are present within the nuclear membrane. The protoplasm around these nuclei is in general so friable that it is recognizable with difficulty or not at all in most places, so that the nuclei appear naked, as is so often the case in sarcomata preserved in alcohol. Where the cell-body can be seen, the cells appear to be round, oval or irregular, sometimes angular in shape and are not very large. These cells, which constitute the great mass of the tumor, are crowded together without any definite arrangement or architecture. There is a scanty fibrillar or reticular intercellular substance which belongs to narrow, fusiform cells of a fibroblastic type. These latter cells and fibrils make up the delicate supporting framework of the masses of round cells composing the tumor.

Blood vessels are seen in fair number. These, even when of large size, have thin walls which are immediately enveloped by the tumor cells. Some of the superficial veins contain fibrinous thrombi.

In some sections there is a layer of connective tissue between the covering epithelium and the tumor; in others, the tumor reaches the free surface of the sections.

Diagnosis.—Small, round-celled sarcoma.

Remarks.—The tumor probably originated in the lymphatic tissue of the nasal mucous membrane. It might also be designated a lymphosarcoma, but this term has been used in so many different senses, that the application is frequently misleading. The present tumor has not the features of Hodgkin's disease, but resembles certain true sarcomata of lymphatic glands. It has the histologic features of a rapidly growing, true, round-celled sarcoma, such as can originate not only in lymphatic tissue, but in any connective tissue of the body, and is likely to produce metastases.

The fact that the tumors ceased to grow and eventually disappeared, is interesting and remarkable. There is nothing in the sections to point to syphilis as a cause of the tumors. Similar tumors have been known to disappear, but I have no explanation to offer. Evidences of any regressive metamorphosis are not seen in the sections.

<div style="text-align: right">WILLIAM H. WELCH."</div>

(See Fig. 3.)

Professor Welch made the following personal communication:

<div style="text-align: right">"March 13th, 1905.</div>

"My Dear Doctor Levy:

"I should regard the tumor as true round-celled sarcoma and malignant, indeed, as belonging to the type of the more malignant sarcoma; more malignant, for example, than the so-called spindle-celled sarcomata. But I know from experience that it is unsafe to make as positive a statement about the clinical course of sarcomata as about carcinoma, and cases apparently alike may pursue quite different courses.

The fact that tumors with every microscopic appearance of malignant growths may spontaneously disappear is known, but it is so rare and the conditions for such disappearance so
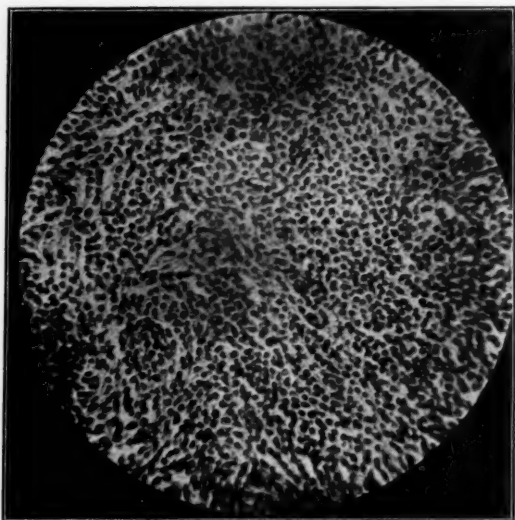
Fig. 3.

unknown, that such an observation as yours should be re-ported with the microscopic findings. This occurrence is more common with sarcomata of this general type than with other forms of tumor.   Very sincerely yours,

WILLIAM H. WELCH."

Under date of October 9th, 1905, in complying with my request for a statement as to his mother, Dr. C. replied "that there are no signs of anything in the nose, but that the growths on her legs have grown quite rapidly, and that one of them is discharging freely. She is now hardly able to walk and is failing rapidly." The return of these growths on the legs began about May, 1905, multiplying rapidly until twenty-five or thirty about the size of walnuts were found between the knee and ankle. About July 1st, 1905, these be-gan to ulcerate. The patient was confined to her bed about January 1st, 1906, and died March 3rd of exhaustion.

A post-mortem examination of the legs was made by Dr.

Harding of the pathologic laboratory of the Denver and Gross College of Medicine.

He reported as follows: Right leg, one round nodule three inches in diameter, raised, hard, nonulcerated over the inner side of the calf. Left leg, a line of seven nodules on the crest of the tibia extending from the tubercle to the malleoli. These were firm, nonulcerated and not movable over the bone. Ten similar nodules were scattered over the outer side. One nodule was situated over the inner head of the gastrocnemius, and over the inner side a firm blue ulcerated mass three inches wide extended from two inches below the tubercle of the tibia to the internal malleolus. Microscopic examination of sections from a number of these nodules showed small, round-celled sarcoma. (See Fig. 4.)
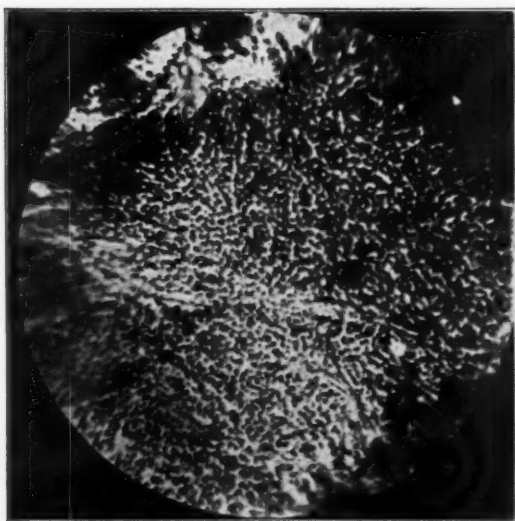
Fig. 4.

The interest attached to the spontaneous disappearance of malignant growths becomes more intense as authentic cases in the literature multiply. The above case is presented in full

detail, as every case should be which deals with a question of such great importance and one which may be subject to much doubt and criticism. From the evidence, however, in the above report, we must conclude:

First.—That so far as our pathology can determine, the case was one of undoubted malignant growth.

Second.—That the nasal tumor completely and spontaneously disappeared.

Third.—That several metastatic growths completely and spontaneoulsy disappeared.

Fourth.—That several metastatic growths markedly retrogressed.

A careful search through the literature reveals reports of disappearing tumors of various characters. Those presenting characteristics of malignant growths are not numerous, and particularly do we find the clinical diagnosis of malignant tumors without a convincing histologic report. That the clinical evidence should not be considered as proof positive is admitted by all, but on the other hand the microscopic diagnosis may also be open to question. Commenting upon the cases of Senger, reported later, in which tumors exhibiting all the microscopic appearance of cancer disappeared, Freeman (1) states that Senger " agrees with Gussenbauer that they were probably not true sarcomata, the clinical evidence being perhaps more trustworthy than the microscopic in such cases."

It is, therefore, contended:

First, that clinical and microscopic evidences should agree and be indisputable, and

Second, that one may accept the diagnosis of either clinician or pathologist, providing these are of recognized ability and authority.

Cases Recorded.

J. Gregg Smith (2) reports three cases.

1. Patient, male 25 years. Sent to hospital June 1st, 1889. Intestinal obstruction. Solid tumor as large as cocoanut occupying left iliac region. Intestines adherent to it. Sarcoma was diagnosed. Intestinal evacuation and drainage. Enterostomy in lower ileum. Feces passed through artificial openings for two weeks, then began to appear per rectum. At end of six months artificial opening was closed. No tumor

could be felt through the parietes, and at time of operation the finger in incision felt only adhesions. Patient recovered, and after four and one-half years is well.

2. Widow, aged 50. October 26, 1889, after gradually increasing weakness for some time, had first noticed swelling in abdomen (umbilical region), adherent to skin and movable with parieties. November 8th operation. Two drachms of muco-pus lying under skin of umbilicus was evacuated. No sinus discovered. Tumor explored, and by reason of adhesions removal was not attempted. Growth believed to be cancerous, and hopeless prognosis given. Gradual loss of strength and flesh, sallow complexion, no pain, no elevation of temperature. Patient, however, began to improve. A sinus discharged pus for a year, ceased six months and then returned. Healed finally. Patient seems entirely recovered.

3. Nursemaid, 19 years. Entered hospital January 9th, 1892, complaining of general weakness for six months past. Had noticed swelling on right side of abdomen which gradually increased in size. Tumor solid and size of eight months pregnant uterus. January 11th growth exposed by incision four inches in length. Adhesions between growth and parietes separated. All present believed growth malignant, and as it adhered behind and at the top under the ribs and with unmovable organs, operation was abandoned. January 19th wound began to gape, and soon a fecal fistula formed, through which for three months all the feces passed, while the tumor gradually decreased. May 1st opening closed. May 6th wound was found quite healed. June 21st patient entirely well and has so continued.

Remarks.—The author by a process of elimination concludes that all three of these cases were malignant growths which spontaneously disappeared. The only authority for his diagnosis was the clinical appearance, the fact that upon section of Case 2 the mass presented a gray, glistening appearance similar to that of sarcoma, and the opinon of others present at the operation.

Barker (3) reports a case of tumor which he believes to have been sarcoma situated under the angle of the right jaw. Upon operation tumor was so firmly attached to the transverse process of the vertebra that the operation was abandoned. Four years later the entire growth had disappeared.

G. M. Smith (4), after speaking of the very few reports

and the difficulty of making an exact diagnosis, reports the following case:

W. R. C., aged 52, gardener. Admitted to hospital in March, 1894. First noticed swelling at angle of right jaw in May. No syphilis, tuberculosis or former lesion. Growth was removed and found to be encapsulated, but firmly attached to masseter and other structures, two inches by one in diameter. Microscopically small round cells were the chief constituent, and there was little stroma. Wound healed.

In August, 1895, readmitted, because of smooth, firm lobulated swelling involving parts behind and beneath the angle of jaw (right side) and extending downward anteriorly to the sternomastoid. Slight pain. Considered a recurrence, and operation decided upon. Growth similar to former, but extended deeply into the neck and was adherent to the prevertebral muscles. It was found impossible to remove tumor. Wound plugged with gauze. Wound healed by granulation in three weeks. Patient left hospital for two or three weeks. On his return tumor had decreased in size. Four and one-half months after operation there appeared no trace of the swelling, but there was a small, hard gland on opposite side of neck.

In February, 1896, a circular ulcer appeared upon fauces and right tonsil.

Treatment.—Iodid of potassium, which was of little avail. However, under no special treatment but rest in bed and antiseptic washes, the malignant looking ulcer disappeared.

In July, 1896, patient was suffering with "round lump just beneath his left ear, firm, pigmented and increasing in size." Abdominal walls were tense from the presence of ascites. Edema of limbs and scrotum. Several subcutaneous nodules on arms and legs. Diagnosis of malignant growth made and the case seemed hopeless. In seven weeks' time edema began to disappear and gradually left an apparently healthy abdomen. Meanwhile, lump on neck began to increase, and in December it was as large as an orange, fungating, soft and dark reddisn. Frequently bled from the foul cauliflower-like excrecences with which it was covered. Removal of this large superficial tumor. Its base was indurated and the deep structures of neck were involved. No attempt made to remove this. "Some attempts at healing took place." However, in groins, forearms and legs, several lumps were present

which presented all the appearances of sarcomatous deposits. Microscopic examination showed small, round cells with numerous blood vessels and very little stroma. The subcutaneous nodules rapidly developed in size and number. Death. No post-mortem.

Remarks.—The author believed that the primary lesion was a lymphosarcoma at the angle of the jaw. After extirpation, it recurred, and after unsuccessful attempt at removal spontaneously disappeared. The ulcer on tonsil and the ascites seemed clearly malignant, yet recovery was made from both. Author, therefore, has the belief that from the microscopic examination, the clinical features and the termination by numerous pigmented tumors is strong evidence in favor of "the whole cycle of events being malignant."

Dwight (5) reports an apparently benign tumor which disappeared, but mentions two cases of Sir James Paget. One multiple medullary sarcoma occurring on the neck and in the axilla. A large mass over one deltoid suppurated and sloughed, during which process the other growths disappeared. The man recovered and enjoyed good health for some time, but recurrence took place and the patient died. The other, medullary cancer of an undescended testis. The tumor was very large and disappeared. Recurred four times before death resulted. Both cases were confirmed microscopically.

Bennett (6) relates the following nine cases:

1. Female, aged 36. Tumor in abdomen, right side, immediately below liver. Mass gradually increased. Emaciation and cachexia. Abdomen opened and liver and omentum appeared to be involved. A portion was excised for microscopic examination and subsequently reported to be a typical specimen of mixed and spindle-celled sarcoma. No removal save as stated above, and prognosis considered grave. In eighteen months, however, tumor had vanished and patient was healthy.

2. Female, aged 52 years. Melanotic sarcoma of the sole of the foot which was excised. A few months later recurrence and amputation. Two months later small blackish tumors appeared on thighs and increased to the number of sixty-two. Microscopic examination showed them to be typical "round-celled sarcoma without pigment." Consultation was held and no operation was decided upon. Six months later she presented but three nodules and later was entirely healthy.

3. Another case almost identical with No. 2.

4. Male, 48 years. A tumor thought to be a hydrocele had existed for nine years and unchanged in size for seven. Trocar inserted without result. Later, by means of a large trocar and canula, some tissue was secured for examination. Diagnosis was sarcoma, confirmed by microscope. Castration postponed and within six months growth had disappeared.

5. Another case identical with No. 4, except that diagnosis was not confirmed by microscopic examination.

6. In this and the following case, the diagnosis was made from clinical characteristics. Patient middle-aged man. Emaciation and cachectic appearance. Abdominal section showed orange sized mass involving pylorus, together with nodules in omentum and around liver. Gastrojejunostomy performed. Rapid recovery from operation, and tumor after five years is imperceptible.

7. Female, of middle age. Large tumor in lower part of neck. Sallow. Below the tumor on right side was a large glandular mass. Operation believed not to be justified, but all physicians who made examination thought tumor malignant. A few months later mass began to shrink and finally disappeared with consequent restoration of health.

8. In this case an encephaloid carcinoma was removed from the testicle of a man 40 years of age. This was followed by a tumor being found near liver. Patient's condition grew gradually worse and fatal termination was thought inevitable. Disappearance within six months and restoration to health.

9. Unmarried woman, 36 years of age, with scirrhous carcinoma of left mamma. Removal three years later, seemed to be involvement of right breast and consequent removal. Soon after second operation, hard nodules appeared along scar of first operation wound, followed by others in the skin, which appeared typical. She paid no attention to these, and seems now healthy.

Remarks.—Of these nine cases, Cases 6 and 7 are open to question. The clinical characteristics were, however, distinctly conclusive.

D'Arcy Powers (7) reports five vanishing tumors, three of which he believes to have been malignant.

1. Male, 21 years. Tumor situated between umbilicus and

pubes, size of a cocoanut. Could be felt per rectum. Incision was made through the lienea alba, but tumor was too firmly attached to be removed. Incision was closed and patient left hospital with no noticeable decrease in its size. Three months later tumor had entirely disappeared.

Author believes tumor to have been sarcomatous, basing belief on rapid growth, firm connection with pelvic bones, progressive loss of weight and appearance of tumor at the exploratory incision.

2. Male, 54 years. Emaciation. Tumor in abdomen just below liver. Exploratory incision showed that on account of adhesions, growth could not be removed. Four months later, tumor had disappeared. Several months later, however, he died from jaundice, and autopsy showed malignant growth at head of pancreas.

3. Patient, 24 years. Following blow on head, tumor developed, subsequently followed by six or eight others in different parts of head. Still another developed, which was removed. Microscopic examination showed it to be a fibrosarcoma. The others disappeared spontaneously, but patient nevertheless succumbed.

In summing up, the author states: " In a cancer, such a disappearance (spontaneous) seems to be quite inconceivable, unless we assume the disease to be one of an infective character, in which the result as measured by the growth, is in direct proportion to the amount of poison absorbed or manufactured within a body which is more or less predisposed to its action."

D'Aguanno (8) discusses the question of the disappearance of malignant tumors, and refers to the fact that Ziegler believes this impossible and that the disappearance is only temporary, resulting in later new development. Their partial disappearance is, however, observed. He relates the case of a boy aged 13, where a malignant tumor disappeared. The author's conclusions are as follows:

"1. The reduction or spontaneous disappearance of growth may occur with regard to tumors of the pharynx and nasopharyngeal space as elsewhere.

2. This retrogressive feature takes place not only in cases of benign tumors, or for adenoid vegetations where it is the rule, but also in case of tumors of malignant nature whether

they take their origin in the conective tissue or originate in the epithelial tissues.

3. This retrogressive process occurs most often (outside of the cases of parasitic infection) through alterations of the stroma of the vascular walls of the tumor and their contents.

Plenio (9) reports the case of a patient 22 years of age, famale. Hereditary antecedents negative. Two years before had noticed a "thickness" under the skin over the right gluteal muscle which had during the last eight months spread to the inguinal region. Tumors increased in size rapidly. In September, 1883, patient was brought to hospital and physical examination showed well-nourished, well-built woman; there was an enormous tumor over the right gluteal muscles; the skin could not be moved over the mass easily and in the center was colored blue. Tumor was of very hard consistency. Measurements were from the spine to the os sacrum 39 cm., oppositely 26 cm. Another tumor of hard consistency was found in the inguinal region. Diagnosis was made of sarcoma. On following day the small tumor was removed, but it appeared impossible to remove the larger growth entire, though some adhesions were broken up and a part removed. Prognosis was given as very grave. Preparations of salicylic acid were used. (Microscopic examination of the excised part of tumor showed it to be a melanosarcoma.) Patient contracted pneumonia, and as this disease left her the tumor gradually decreased in size. December 6th there was but an "infiltration palpable." During the year 1884 the growth entirely disappeared, appetite returned and general state of health was normal. In 1885 patient was again seen; was eight months pregnant, and in perfect health.

Warthin and Spitsley (10) have related a number of vanishing tumors of non-malignant character reaching the following conclusions:

First.—That in spite of skillful clinical observation, the ultimate behavior of a tumor is seldom to be determined except by microscopic examination, and that many seeming malignant neoplasms are taken to be such when really they are but the outcome of an inflammatory condition.

Second.—That probably no true neoplasm, malignant in nature, ever disappeared except through retrograde changes induced into itself through infection of the tumor tissue, or through affections or infections of other parts of the body

having, by reason of toxins, practically the same effect. To this there are extremely rare exceptions in which the disappearance of the growth takes place by an egress or by retrograde processes over those of growth.

Third.—We must look to the inflammatory process, acute or chronic, for the explanation of the appearance or disappearance of these masses of tissue, which before and even during exploration appear to be actual new growths.

Watson (11) relates the following: Patient, a woman aged 36, presented a large pendulous tumor attached to left side of the back; growth presented the appearance of a lipoma undergoing degeneration. Growth was removed and several independent microscopic examinations showed it to be a mixed round and spindle-cell sarcoma. A week after operation, wound ulcerated and tumor rapidly reappeared, quickly reaching to former size. The growth was so extensive that its thorough removal was considered impossible. After a time the tumor began to decrease and gradually shrank, and the wound entirely cicatrized. One year after operation, the patient was in excellent health, the tumor was less prominent and hung as a loose sack of skin. Except for the ulceration, no inflammatory phenomena presented themselves locally after the operation.

Remarks.—The fact that ulceration occurred and was accompanied by fever offers an explanation of the disappearance of the sarcoma in this case. The author quotes Wyeth as having pointed out the value of infection as a cure in sarcoma.

Randolph (12) presents a patient, male, aged 43. Three years before, there appeared on the posterior aspect of the left forearm, about the junction of the upper and middle thirds, a small nodule beneath the skin, which was movable and painless. The mass grew for six months, remained stationary then until two weeks before operation, when it exhibited signs of inflammatory reaction. The mass was excised and two weeks later the wound had healed by primary union. There is no evidence of recurrence.

Pathologic Report.—The mass is flattened, slightly elliptical, 1½x2¾ inches. It has no capsule but has an envelope which is derived from the surrounding connective tissue. On section it presents a grayish white appearance, composed of dry friable fibrous material.

His conclusions are:

First—That a sarcomatous growth started in the subcutaneous connective tissue.

Second—That it grew steadily for six months and then for some unknown reason became arrested.

Third—That a necrosis or atrophy of the cells of the tumor took place.

Fourth—That later the inactive tissue began to act as an irritant and the response was productive of inflammatory process which endeavored to remove a foreign body.

Fifth—The very abundant presence and peculiar change of the giant cells seem to show that the function of these cells is an absorptive one. In the discussion Dr. Stengel said that he had under observation a patient with multiple sarcoma in which the tumor at times disappeared. It was, he said, difficult to understand the disappearance of carcinoma, sarcoma and tuberculous growths.

Dr. Leonard Freeman (13) makes the statement that fibrous cancers of the breast occasionally undergo spontaneous cure, especially in old women, and quotes Billroth and Kaposi (14), who assert that superficial epitheliomata of the skin sometimes heal without treatment. He relates Stoerck's case of epithelioma of the tonsil which disappeared without interference, but in which recurrence took place in one year. He also records the following case:

A man, aged 38, giving no history of syphilis, developed a small, superficial, indurated sore, on the right half of the lower lip at the mucocutaneous junction. After partially disappearing and again enlarging, the ulcer finally disappeared, leaving a slight scar. Less than a year afterwards and nearly two years from the beginning of the disease on the lip, a swelling was noticed in the right submaxillary region. Nine or ten months later this was removed. Local recurrence took place within three weeks. After another operation the growth was temporarily checked, recurring, however, and destroying the patient. Microscopic examination of the tumor in the neck showed typical epithelioma.

Freeman concludes that although microscopic evidence of the cancerous nature of the original ulcer of the lip was wanting, circumstantial evidence, presumably the development of a secondary malignant growth, was so strong as to admit of no reasonable doubt.

Gaylord and Clowes (15) have found, in addition to the above cases, the following:

Senger (16). Epithelioma of the tongue with complete disappearance, leaving nothing but a scar in the mucosa. No recurrence one year later.

Crosbie (17). Cancer of the lip in which the diagnosis of malignancy was confirmed by pathologic examination. After a small portion was removed by scissors the remaining disappeared entirely.

Gould (18). A woman presented a typical scirrhous cancer of the breast, which was removed, and upon microscopic examination the diagnosis was confirmed. Later, recurring nodules were found around the scar. She was considered inoperable and although symptoms of metastatic growths elsewhere developed to a considerable extent, these all finally disappeared. The patient gained flesh and returned to apparent health. The skin nodules as well as an enlarged gland in the axilla and neck all disappeared.

Rotter (19). A case of malignant adenoma of the rectum followed by spontaneous healing. Diagnosis was confirmed by microscopic examination by Orth. Rectum was extirpated, recurrence took place, the diagnosis of which was again confirmed by the microscope. There were numerous curettings, each, however, followed by such rapid recurrence that the patient was finally discharged incurable April 18, 1896. In July, 1896, Rotter again examined the case and was surprised to find all evidence of tumor absent, the growth having apparently completely disappeared. Death occurred three years later from metastasis.

Tripier (20) reports two cases of sarcoma, the diagnosis of one being doubtful. The other was a case of numerous nodules in theepitrocllear and epicondylian region of both limbs with numerous nodules elsewhere. Microscopic examination of one nodule was positive. At last examination, six years later, the patient was in apparently good health, tumors having completely disappeared.

Hormann (21). Chorion carcinoma of the uterus with metastatis in the vaginal wall. Microscopic diagnosis was made by Albrecht. Numerous curettings were done but no radical operation. The patient became pregnant and was delivered at term followed by normal return of menses. Three

years after first examination all evidence of tumor had disappeared, patient being in apparent good health.

Noble (22). Chorion carcinoma with partial removal through hysterectomy. Sixteen months after operation patient presented every appearance of good health and careful examination failed to show any evidence of tumor. Diagnosis in this case was confirmed by the microscope.

Littauer (23). Soft nodule in the uterus. Scrapings showed epithelial proliferation. No operation was performed. Examinations of scrapings of second curetting was negative. One year after curettage, patient was entirely well.

Fleishmann (24). Nodule on vaginal wall and enlarged uterus. Nodule was removed and uterus curetted. Microscopic diagnosis was chorion cancer. Ten months later, no evidence of tumor could be detected.

Von Franque (25). Case of chorion cancer. Diagnosis confirmed by microscope. Uterus curetted, followed by restoration to complete health.

Langhans (26). Vaginal nodule, recurrence after removal. Nodule finally broke down and healed spontaneously. Microscopic examination positive. Complete recovery ten months later.

In view of the authentic cases reported above and of the animal experiments beginning with those of Wehr in 1883, down to those of Gaylord and Clowes, it must be conceded that undoubted cases of malignant growths disappear spontaneously.

As to the nature of the process involved, the peculiarities or causes for the same, we must turn to further investigations of the pathologist. The clinician can only report clinical facts, but it is to the laboratory that we must look for causes.

REFERENCES.

1. Trans. American Surg. Ass'n, Vol. xviii, p. 302.
2. Med. Chir. Trans., 1894, Vol. lxxvii, p. 139.
3. Proc. Royal Med. Chir. Society, London, 1892-94, p. 44.
4. Bristol Med. Chir. Journal, 1900, Vol. xviii.
5. Boston Med. & Surg. Jour., Dec., 1880, p. 562.
6. London Lancet, 1899, Vol. i, p. 3.
7. London Lancet, 1899, Vol. i, p. 584.
8. Boll. d. Mal. dell. Orecchio, etc., Oct., 1899, p. 237.
9. Arch. f. klin. Chir., 1886, Vol. xxxiv, p. 698.

10. New York Med. News, 1901, Vol. lxxix, p. 442.
11. London Lancet, Feb. 1st, 1902, p. 300.
12. Proc. Society of Philadelphia, Vol. vii, 1904, p. 130.
13. Trans. Med. & Surg. Ass'n, 1900, Vol. xviii, p. 303.
14. Path. u. Haut. Krank., 1887, p. 871.
15. Surg., Gyn. & Obst., Vol. ii, June, 1906, p. 633.
16. Verhandl. d. deut. Ges. f. Chir., 1894, i, p. 171.
17. Brit. Med. Jour., Feb. 11, 1899, p. 338.
18. Clinical Society's Trans., vol. xxx.
19. Arch. f. klin. Chir., Vol. lviii, p. 357, 1899.
20. Lyon Medical, 1876.
21. Hagar's Beitrage z. Geb. u. Gyn., bd. viii, h. 3, 1904.
22. American Jour. of Obst., Vol. xlvi, No. 3, p. 289.
23. Arch. f. Gyn., Vol. lxxii, p. 294.
24. Monatsschrift f. Geb. u. Gyn., bd. xvii, h. 4.
25. Zeit. f. Geb. u. Gyn., bd. xlix, h. i.
26. Beitr. z. Geb. u. Gyn., bd. v, h. i, 1901.

LIX.

MIDDLE EAR SUPPURATION AS AN ETIOLOGIC FACTOR IN RETROPHARYNGEAL ABSCESS.

By E. I. Holmes, M. D.,

BOSTON.

The frequency with which suppurative processes in the middle ear extend into the mastoid cells, and occasionally from these into the cranial cavity above and the digastric fossa below, is generally well known. Judging by experience, and a study of the literature, the invasion forward into the pharyngeal structures is exceedingly rare. Indeed, retropharyngeal abscess in the adult from any cause is a rare condition.

The formation of pus with the accompanying changes in the mucous membranes of the mastoid cells, causes pressure upon and a general stasis within the vessels nourishing both the mucous membranes and the bony framework of the whole mastoid area. The only natural drain of the mastoid cells is the aditus, which is situated at the top of the cavities when the head is near the upright or horizontal position, and at the best is small, and offers a poor channel for the discharge of thick pus. The maintenance of a free circulation is an important factor in the prevention of a destructive process, as well as in the repair of an injured tissue. For this reason all suppurative processes are given early surgical treatment.

It is evident that in the structures behind the ear we have favorable conditions for a destructive process whenever there is septic invasion, and the reason why the destructive processes so rarely advance forward, is likely that the Eustachian tube and pocket which lodge the tensor tympani muscle give free drainage, which not only liberates the irritating secretions, but avoids pressure upon the local circulation. We can understand how through adhesions and the formation of granulation and polypoid tissue, or other new growth, the drainage of the anterior portion of the middle ear can be interfered with, or entirely blocked.

If there is a suppurative process under these conditions, the Eustachian tube, if patent, may care for the secretions, and thus extensive disease be avoided. When, however, the tube also becomes obliterated, there is no reason why the suppuration should not advance, here producing necrosis of surrounding tissue, as it does in other localities; and this is probably what does take place in the few cases which advance and form abscess cavities behind and about the pharngeal wall.

Even where there is a blocked Eustachian tube and tissue within the middle ear retarding the drainage of pus, the diseased area is so small that only a small amount of secretion would be likely to form, and that so slowly, that only rarely would it produce much pressure.

While it is evident that we have in the tissue behind the ear most favorable conditions for the advance of a suppurative process, there is only very rarely present the conditions necessary for the advance forward of such a process.

In the second century, Galen referred to a case of retropharyngeal abscess. So far as I can learn, one of the earliest reports of cases was by Abercrombie (1), who in 1819 described three cases as observed in children. In 1850, Fleming (2) reported two cases. Henoch during 1850 and 1851 (3) published a report of cases. The elder Bokai (4) in three different papers reported, in all, 129 cases. They were all observed at the Children's Hospital at Pest between 1854 and 1876. His son (5) took up the work and reported 138 cases of his own. There are a large number of writers who have reported one or more cases, but when we search for reports of retropharyngeal abscess in the adult, we are impressed by the comparatively few cases which have been recorded.

As it is not my purpose to discuss the general subject of retropharyngeal abscess, I shall mention only those cases reported as occurring in the adult, as both cases which I report in this paper were in adults and of aural origin.

In a paper presented by Watson (6) in 1903, he reported one case occurring in an adult. He was able to find only 16 other cases reported. Among these were the cases of Gunther, Heald, Syme, Goodale, Bosworth, McCoy, Moore, Lennox-Browne, Fischer, Dunn and Shirley. Besides these I have been able to find the case of a man 46 years of age

reported by Levestine (7), one of an adult by Petrunti, one by Downie (8), of a woman 79 years of age, one by Cheyne (9) in an adult 42 years of age, one by De Blois (10) of a man 27 years of age, one by Berg (11) in an adult, supposed to of tubercular origin, and one by Allen (12) in a man 38 years of age. Lennox-Brown says that in his clinics he sees twice as many cases in adults as children, but he gives no statistics.

Both Bokai, senior and junior, mention the ear when speaking of etiology, but they included no such cases in their statistics, nor did they report the aural conditions existing in their reported cases. Huber (14), in reporting cases, mentions one which ruptured into, and discharged from, the external ear.

Oppenheimer (15) in his paper upon the etiology of retropharyngeal abscess, speaks of the possibility of the retropharyngeal glands becoming infected from a suppurative process in the middle ear.

Klug (16) reported a case of aural origin, with erosion of the carotid artery. Urbano Melzi reported a case of a child 2 years of age, who had a retropharyngeal abscess which he considered of aural origin.

Weil (17) states that suppuration of the tympanic cavity in children is not an infrequent cause of retropharyngeal abscess. He also reports a case of a child who died, where the post-mortem showed extension from ear into retropharyngeal abscess.

In reply to 250 cards of inquiry, addressed to ear, nose and throat surgeons, 147 reported as never having seen a case of retropharyngeal abscess due to middle ear suppuration, ten reported as having seen one or more cases.

Hoping that the discussion of this paper will be taken up by many of the gentlemen who have so kindly submitted their reports, and that then we can find there are sufficient facts to prove beyond reasonable doubt that all belong in these statistics, I submit them as they were presented to me.

Dr. Chevalier Jackson reported as follows: " My notes on retropharyngeal abscess are imperfect, but as I have thought for many years that the frequency of otitis media as the primary pus focus is overlooked, I have rather full notes of twelve cases associated with (and probably secondary to) purulent otitis media. In six of the cases, ear trouble

had not been noticed until I searched for it; in four cases it had been noticed, but was not considered of consequence; in only two was its true etiologic significance recognized. In four of the six unrecognized cases, no discharge was escaping from the canal, the drum membrane being healed or unperforated. In three of the cases, the otitis media might be called chronic; nine were acute. The primary diseases which preceded the otitis were: scarlatina, four; measles, two, diphtheria, two; influenza, two; rhinitis, one; unknown, one. Three showed evidence of hereditary syphilis.

The pus organisms found in the pus of the abscesses were:

> Streptococcus, pure 4
> Staphylococcus, " 1
> Streptococcus ⎫
> Staphylococcus ⎭ mixed........... 2
> Pneumococcus 1
> Not examined 4

(Approximately)

> Ages: Two years.
>   Three "
>   Four   "
>   Two   "
>   Two   "
>   One   "
>   Ten   months,
>   Fifteen   "
>   Six   "
>   Two   "
>   Two   "
>   Fourteen "

> Average about eighteen months.

Sex: Eight were females, four males.

One abscess burst spontaneously before my arrival; one burst during digital examination; one asphyxiated the patient before my arrival; nine were incised. Two were tracheotomized, one for a complicating perichondritis, and one because breathing had stopped during digital examination. Both of these cases recovered. Of the twelve cases, two died, one of asphyxia before my arrival and one of sepsis."

Dr. A. E. Crockett has seen five cases, one of which was reported a year ago in a paper on "Thrombosis of Sinus and Jugular."

Dr. Robert E. Moss has seen three cases, two males, 40 and 65 years of age; one female, 26 years. Both men had mastoid operations.

Dr. F. B. Sprague saw a woman 30 years of age in Politzer's clinic, who had retropharyngeal abscess due to ear extension. He is also treating a man 30 years old for the same condition.

Dr. J. J. Thomas operated on a girl of 7 years of age in whom a middle ear suppuration had extended into nasopharynx. Perfect recovery after incision.

Dr. S. H. Lutz reports case of female, 2 years old. He incised abscess and child left hospital in five or six days.

Dr. D. C. Green, Jr., operated on girl 3½ years old for retropharyngeal abscess, which was undoubtedly due to middle ear inflammation.

Dr. E. W. Day saw a man 18 years of age who had middle ear suppuration since childhood. Patient was in dying condition when first seen, and as there seemed to be obstruction to breathing, a digital examination of throat was made, and a large retropharyngeal abscess found. Opened with finger. Patient died, although no pus entered larynx.

Dr. J. A. Stucky has seen a 3-year-old girl who had retropharyngeal abscess due to an acute middle ear suppuration. Opened with finger. Child made perfect recovery.

Dr. Thomas Hubbard reports the following case: A man, 55 years of agee. O. M. P. A. Neglected. Mastoid suppuration. Bezold perforation. Pus burrowed toward pharynx and discharged spontaneously. No operation other than incison over mastoid allowed. Patient died from exhaustion and general septicemia.

In making a diagnosis, we have the same conditions to differentiate as with retropharyngeal abscess from any other cause. Perhaps the most important thing to eliminate is aneurism. Fortunately, the condition is very rare, comes on slowly, without the septic symptoms, and usually shows more swelling and bulging of tonsil and soft palate. The pillars of the pharynx are usually carried forward and inward to a more marked degree than in retropharyngeal abscess.

A marked, deep, cervical cellulitis, a new growth, or an

injected and swollen gland might be mistaken for a collection of pus. In these conditions we would get no fluctuation.

Whenever we find a retropharyngeal abscess with the history of a chronic discharging ear on the same side, we should at least consider the ear condition as a possible etiologic factor. If possible, a probe should be passed, and the anterior portion of the middle ear explored. In the second case I report, the probe not only detected bare bone but was pressed forward into a cavity, and upon removal considerable pus escaped.

Although we are all familiar with the general anatomy of the pharynx, of the anterior wall of the middle ear, and of the superficial relations of the triangles in the neck, there may be some doubt of the relations between these areas. I found when operating upon the first case, that I was not quite sure about how many important structures might be located between these areas. The large vessels could be distinctly felt by the finger, but the nerves could not be thus located, and I was afraid I might wound or destroy one or more of these.

In reviewing the anatomy of this area I will, for convenience, begin with the pharyngeal wall, a region with which we are all familiar. Here just below the mucous membrane are the three pharyngeal constrictors, with their aponeuroses forming the walls of the pharyngeal tube. These muscles are so arranged that the superior is overlapped by the middle, and the middle by the inferior. This muscular tube is attached above to the pharyngeal spine of the basilar process of the occipital bone, the posterior portion of the mylohyoid ridge of the inferior maxilla, the side of the base of the tongue, the pterygomaxillary ligament, the lower third of the posterior border of the internal pterygoid plate, and the hamular process of that plate. Below it is attached to the posterior part of the side of the cricoid cartilage behind the cricothyroid muscle, to the inferior cornu, the oblique line and the superior border of the alae of the thyroid cartilage. It also attaches to the stylohyoid ligament, the little horn and the whole upper surface of the great horn of the hyoid bone. Directly behind this muscular tube are the anterior vertebral muscles and the lymphatic glands, but at either side is an area somewhat prismatic in shape which is of much interest to

our present study. Above is the lower surface of the posterior portion of the temporal bone, the fibrous floor of the Eustachian tube and a small posterior portion of the great wing of the sphenoid bone. Through this bony superior boundary pass the internal carotid artery, the internal jugular vein, the middle meningeal artery and the pneumogastric, glossopharyngeal, hypoglossal and inferior maxillary nerves. The anterior and outer boundary is made by the ramus of the inferior maxilla and the outer pterygoid plate. Posteriorly, the bony landmark is the styloid process of the temporal bone. There is no fixed lower boundary to this space, and pus can dissect as far as and into the mediastinum. The internal pterygoid muscle occupies much of the antero-external space. Between this muscle and the ramus of the inferior maxilla are the internal maxillary artery and the dental nerves and vessels. There is considerable cellular tissue between the anterior portion of this muscle and the superior constrictor of the pharynx. This cellular tissue offers less resistance to dissecting pus, and here we would expect to find its first appearance when coming from the anterior portion of the tympanum.

A cross section at about the level of the tip of the mastoid shows the following relations: Near the median line the pharyngeal muscles are in contact with the prevertebral muscles. Only a few lymphatics are between them. We find that the pharyngeal tube curves forward, and at either side is an area, somewhat triangular in shape when thus viewed, in which are situated the following structures:

Posteriorly is the internal jugular vein, just at the inside of this is the pneumogastric nerve, slightly anteriorly and internally is the internal carotid artery. These are surrounded by firm fibrous tissue. To the outside and just in front of the internal jugular vein is the tip of the styloid process, and the beginning of the styloglossus, stylopharyngeus and stylohyoid muscles. In front of this is usually found a portion of the parotid gland, which dips deeply into the neck at this area. A short distance in front and to outside of the internal carotid artery is the external carotid artery. In this locality is also situated the hypoglossal and glossopharyngeal nerves. Between these structures and the pharyngeal muscles is an area of loose connective tissue, in which are a number of veins. At the level of the vault of the pharynx, which

is also the level of the bony wall of the Eustachian tube and that of the bone liable to be attacked in extension of middle ear disease, we also find situated, just in front and to outside of this triangular space, the inferior maxillary division of the fifth nerve, the middle and small meningeal arteries, the auriculotemporal nerve and its two roots about the meningeal artery and some of the branches of the internal maxillary artery. It is important to remember the relation of the pneumogastric, the glossopharyngeal and the hypoglossal nerves.

The pneumogastric nerve is to outside of the internal carotid artery and between this and the internal jugular vein. It is in a common sheath with these vessels, and is not liable to injury. The glossopharyngeal nerve leaves the cranial cavity through the jugular foramen. It passes obliquely downward and forward, between the internal jugular vein and the carotid artery; crossing the latter obliquely it passes about the muscles attached to the styloid process, and from here lies upon the middle constrictor of the pharynx, just below the lower border of the body of the inferior maxilla.

The hypoglossal nerve leaves the cranium through the anterior condyloid foramen and descends nearly vertically toward the angle of the jaw. It is internal to the carotid artery and internal jugular vein. It passes forward and between these, and finally about the posterior belly of the digastric muscle. It passes around the occipital artery, and over the external carotid and facial arteries. Near the great horn of the hyoid bone, it crosses over the superior laryngeal nerve.

The bone liable to be involved in a necrotic extension from the middle ear is just in front and to outside of the great vessels as they pass through the base of the skull, and just in back of the meningeal artery and inferior maxillary nerve. The distance between these structures is only about half an inch. In exploring this area, the finger is carried through the pharyngeal opening, and then directed outward, pointing toward the external auditory canal. The large vessels can be felt just in back and to inside, and are a good guide to the region we wish to inspect.

When there is a formation of retropharyngeal abscess from a previous suppurative process in the ear, the chances are that we have not only soft necrotic tissue but also diseased and broken-down bone. This necrotic bone demands the attention

of the operator, for unless it can be removed the chances are that there will not be satisfactory results following the operation, any more than there are when such conditions are not eliminated during the mastoid or any other operation where bony structures are involved.

We find a diversity of opinion among good operators as to the best methods of reaching and treating retropharyngeal abscess. Burkhardt (17) of Stuttgart in 1888 described a method for external operation, and he strongly advocated his method in a very excellent paper. He advised an incision in front of the sterno-cleido-mastoid muscle, and at level of the larynx. The thyroid vessels are carried backward, and the larynx forward, and the incision carried into the deep retropharyngeal area. In this locality the carotid gives off no branches, and the incision is below the hypoglossal and glossopharyngeal nerves.

Chiene of Edinburgh (18) advocates making an incision from the mastoid proceess downward, just back of the sterno-cleido muscle. Then by direct dissection reach the styloid process, with the muscles and ligament-like fascia; from this the dissection is carried inward and upward into the retropharyngeal space. Those who advocate the external routes are apparently about equally divided as to the choice of these two methods. The advantage claimed for the external operation is that a thoroughly aseptic operation can be performed only in this manner, that diseased tissue can be removed without haste and without danger of materials entering the larynx. This may be true when dealing with broken-down glands (tubercular), but when the infection has come from the ear the chances are that the same pyogenic organisms are present in the abscess which are present in the ear and pharynx. In this case the pharyngeal wound can care for and resist infection as well as if not better than the tissues about the incision in the neck.

Unless there has been extension into the cervical structures, the majority of the operators are inclined to open these abscesses through the pharyngeal wall. Although I made a free opening through pharyngeal wall, and through the ear, and obtained a profuse discharge from both, it was necessary to perform a secondary operation upon one case, and that from the outside, as the pus continued to dissect downward and outward. The diseased bone is at such depth that it is prac-

tically possible to explore it only by the sense of touch, and the usual external openings offer no better opportunity than the pharyngeal incision.

This area of disease in the petrous bone is at the level of the condyle of the jaw. The space between the ramus of the jaw and the mastoid process is very narrow at the best. The styloid process with the attached muscle is in this space, and obscures the area of the disease. The only way in which direct inspection of this area can be obtained and still save the articulation of the inferior maxilla is by incising the ramus, and then rotating the upper portion upward, outward and backward. Even by this procedure, we have to sever a portion of the masseter and internal pterygoid muscles. The hemorrhage is hard to control, and the resulting deformity is likely to be marked. The parotid gland would be liable to be injured, and there would be considerable loss of power of mastication.

Were it not for preserving the articulation of the maxilla, the ideal method would be to remove the condyle of the maxilla, and the anterior wall of the external auditory canal. By this procedure the important vessels and nerves could be avoided, and if a given case refused to heal after the other means had been tried and should there be signs of necrotic bone, this operation might become necessary.

There is still another avenue of attack, and that is through the cranial cavity, and of course would only be resorted to in case there were unmistakable signs of cerebral invasion of the suppurative process. A trephine could be made just above and in front of the external auditory canal where by elevating the dura the anterior portion of the petrous portion of the temporal bone could be exposed and explored, and any diseased portion removed.

The first case of retropharyngeal abscess due to extension from the middle ear which came under my care was Mary McD., age 14, who was admitted to the Boston City Hospital, June 21, 1900. She gave a good family history, with the exception of having lost one brother with pulmonary tuberculosis. Her personal history was comparatively free from disease, having had measles at 4 years. The only other trouble was a discharge from left ear. This began when she was a small child. The discharge had varied much in character and amount, but there had been no particular annoyance, ex-

cept from the disagreeable odor. This had been at various times separated by long intervals of comparative freedom from symptoms. Present history: Four days ago, began with a severe pain in and about left ear, extending into throat and lasting for twenty-four hours. Later, pain was worse in left side of face. Three days ago, throat began to swell, and neck was swollen on outside. For two days has been very hard to swallow, and breathing has been rather difficult. Has been worse to-day, and therefore came to hospital. The patient was a fairly large and well-nourished girl, but presented the appearance of marked sepsis. The temperature was 103°, the pulse 120°. The left side of face was swollen, especially at angle of jaw and below ear. The sterno-cleido muscle was tense. The deep vervical glands on left side were much enlarged. Both pupils were normal. Lungs and heart were normal. Left auditory canal was much swollen, and there was very foul-smelling pus in canal. There was much granulation tissue in the middle ear, and it was impossible to see the general landmarks. A fine aural probe detected areas of bare bone. I tried to direct probe into the Eustachian tube, but was not successful, as the anterior portion of the tympanum seemed filled with soft polypoid tissue.

Examination of throat showed a marked swelling of the posterior pharyngeal wall, mostly on the left side, the lateral wall was pushed forward, carrying the left tonsil with the pillars forward. Had it not been for the pharyngeal swelling, it would have been very easy to mistake the condition for a peritonsillar abscess. The mucous membrane of the right side of pharynx was of a dark red color and swollen, but that covering the pronounced swelling was dark (bluish) red, almost a black, more like that covering the base of tongue when there is a marked varicose condition of the lingual veins. I was much impressed by this dark color, as was Dr. Taylor, the house surgeon. Before I examined the case he told me that the throat was black in color. This dark color was probably due to a venous stasis caused by pressure on the veins relieving this area. There was a wound in the palate which Dr. Taylor had made in the belief that he would reach pus, as he was of the opinion that we had a peritonsillar abscess which had extended backward.

Palpation showed a tense, non-pulsating but fluctuating mass

on the left posterior pharyngeal wall, which extended at least as low as the upper rim of the glottis. It took up the whole lateral wall of the pharynx, pushing the left tonsil far forward. The tonsil, however, showed very little if any swelling.

I advised an immediate operation for both opening the pharyngeal abscess and removing the granulation tissue in the middle ear. I did not propose performing a thorough exenteration upon the ear, as I felt the gravest condition was the large collection of pus in the throat, and as the patient's condition was rather poor, the pulse being weak, and the general appearance being that of profound sepsis.

The ear was cleaned with a sterile solution, followed by one of mild corrosive sublimate. Fearing that a tracheotomy might be necessary, the neck was cleansed and a corrosive pad applied. The patient took ether without trouble, and was placed in a semi-Trendlenberg position, with the head held to the left side. The tongue was caught by a tenaculum forceps and carried forward out of the mouth, which was opened as far as possible, and this was sufficient to give fairly good space for operating. To avoid a too sudden escape of pus, I made an incision about 1-3 of an inch in length above and to the left of the median line. Fully three ounces of a rather dark colored, foul smelling pus was immediate evacuated. The odor was similar to that found in a gangrenous appendix. The incision was now enlarged by inserting blunt scissors and then spreading the blades. In this manner an opening sufficient to admit the finger was obtained. I could not reach the bottom of the cavity, but could distinctly feel the great vessels, and while carrying the finger upward and backward it came in contact with rough bare bone. I now passed a probe beside the finger and demonstrated its contact with bone to those assisting in the operation. A very fine probe was used, and while moving it carefully over this area it entered a sinus and through this into the middle ear. I now passed a probe into the external auditory canal, and was able to make contact with the one which was passed from the throat. With a ring curette, as much of the soft granulation tissue was removed from the middle ear as possible, and with the index finger of the left hand in contact with the exposed and necrotic bone in the abscess cavity, I gently removed with the small middle ear curette with a curved shank,

a little at a time, the brittle bone, until the curette could be felt with the finger. This was carried as far as I dared, and until the bone was apparently much less brittle. A large abdominal probe was then passed through the throat and out of the ear. It was a question whether to make an external incision so that the deeper portion of the abscess cavity could be inspected and more thoroughly cleansed, or to trust to the drainage already made. The pulse was 130 and not of too good tension, and as much time had already been taken in the operation it seemed best to cleanse the cavity of debris and await developments. The cavity was thoroughly cleansed with sterile water, and a drainage tube passed through auditory canal into the abscess cavity. The pharyngeal opening was packed with iodoform gauze. June 23, the following day, the patient had made a good recovery from ether, the pulse was 96, the temperature fluctuated between 100° and 104°, as shown by accompanying chart. There was profuse discharge through the tube, and also into throat. The packing was removed from the throat, the wound thoroughly cleansed and a fresh iodoform packing inserted. The throat was sprayed every two hours with antipyrin and Dobell's solution.

On June 24, the second day after the operation, the cellulitis of neck had extended over left side of face. The left eye was nearly closed. The lower neck had become swollen, the whole resembling somewhat that of erysipelas. At angle of the jaw and below the ear was a swelling which showed fluctuation. Pressure on this did not force pus through channels already made. It seemed advisable to give vent to this collection of pus, and another operation was advised. The patient was again etherized, and an incision made just in front of the sterno-cleido mastoid. After retracting the skin the fascia was found to be tense, and as soon as this was severed pus of the same character as that found in the other abscess was evacuated. This pus had dissected into the area of the superior cervical triangle. This cavity was about the size of a dove's egg, and a probe with which I was exploring the walls passed into the abscess cavity above, and was passed into the throat through the pharyngeal opening. The cavity was cleansed with a dull curette and packed with gauze, and a perforated rubber tube inserted. June 25, the day following the conditions were apparently improved, patient felt much

more comfortable, had called for food and had swallowed three egg-noggs. The nutrient enemata which she held very poorly were stopped. There was much pus coming from the tube in ear, and also passing through the pharyngeal tube into throat. There was almost none escaping from the cervical wound. Twenty-four hours later, as there was so little discharge from the cervical wound, the gauze was removed. The swelling of face and lower cervical area was very much less, and the general conditions were much improved. The patient was losing the marked septic appearance. By June 28, the cellulitis of the face was nearly gone. There was only slight discharge from the cervical wound, and the discharge from ear, though considerable, was less than at first. The patient was taking considerable liquid, and was gaining much in strength.

There was nothing of importance to note again until July 2, when the tube was removed from the external opening. The pharyngeal opening was becoming small, but considerable pus was removed each day when the cavity was cleansed. There was considerable granulation tissue in middle ear which was removed by curette.

July 9. The pharyngeal wound was entirely closed; the discharge from ear being thick, a solution containing papain and .2 of 1% of HCl was given to use three times a day.

July 21. There has been constant improvement, the discharge has steadily become less and much thinner; at present it is more like serum in appearance. The patient is discharged from the hospital to report at the out patient department for treatment.

She was treated at the O. P. D. for a few days, and then, feeling so well, stopped coming. I saw patient again in January, 1902, when she visited the Boston Dispensary, to learn if anything could be done to improve her hearing. The middle ear was perfectly dry, and had the whitish appearance of epidermis. A probe could not enter the Eustachian tube. The hearing was poor; could hear watch on contact, Politzer's acumeter about three inches. The 5C forks were:

		C	Ci	Cii	Ciii	Civ	
R	a	38	43	48	37	7	24'
	b			14			
L	a	0	0	5	8	6	Whisper
	b			17			8''

On November 8, 1900, Dr. McDonald of Brookline, who was taking a clinical course with me at the Boston City Hospital when I operated upon the case just reported, brought a patient, Miss Annie W., to the St. Elizabeth's Hospital for examination of her throat. She was 26 years old and had always been well, except for a suppuration in the right ear, which she had been annoyed by, off and on, since a baby. Her father and mother were both alive and in good health. Three brothers and four sisters had always been in good health. She had had attacks of pain in the right side of throat at various times for the past three years. Several physicians, both in and out of hospitals, had examined the throat, and told her there was nothing in the throat to be found, and the pain was probably reflected from the ear, or from some tooth. A spur had been removed from the right side of nose at the Boston Dispensary two years before, in hope that this was the cause of the pain located in the throat. About October 23, she had another attack of the same pain, located in the right side of the throat. There were several attacks of chilliness but no rigor, followed by what she called fever turns. She consulted a physician, who advised her to have a tooth extracted. This was the right inferior twelve-year molar, which had been cariosed for some time. Two days later she had the tooth removed, but was not relieved for four days. Following this there was a cessation of pain for three days, when it began to be more severe than at any other time. There was a distinct chill, and marked weakness. Dr. McDonald was called to see patient and found her with a pulse of 94, and a temperature of 101.8°. This was in the morning of November 2. Examination showed nothing in the throat. The right ear was filled with foul thick pus, and, after syringing, the internal wall was found to be covered with granulation tissue. There was tenderness in front of ear and back of angle of jaw. This he thought due to inflammation in the ear, and ordered hot sterile douches every hour. At 8 o'clock in the evening, the temperature was 103.4° and patient appeared much worse, but Dr. McDonald said he could find no signs of trouble in the throat. He prescribed calomel followed by salts, and applied heat in form of poultices in front of the ear. Following day, the temperature was lower, and the pain and other symptoms seemed relieved. The treatment of ear was continued. There

was apparent improvement for two days, when there was another exacerbation. During this attack, no new symptoms or signs presented, and in 48 hours there was considerable improvement. On the morning of November 8, there began to be more pain, and the patient was brought to the hospital, where I saw her at about 11 o'clock in the morning. She had a temperature of 100.8°. There was no external swelling visible, but pressure into space between angle of jaw and the mastoid process caused pain, and there was induration which we could both distinguish. When the mouth was opened there was more pain, yet it was opened without much apparent effort. Both tonsils were rather large and follicular. The whole pharynx was of a darker red color than normal, but I could see no apparent swelling. When the finger was used there was a distinct difference in the two sides, the right was much more tense, but there was nothing to suggest fluctuation, and had I not seen the other case so recently I would not have given much thought to the idea of a retropharyngeal abscess. The right ear showed considerable swelling of external canal, and a firm polypoid mass was in the anterior portion of the tympanum. A probe came in contact with bare bone in the attic, yet I could not carry it anteriorly about the granulation mass. I advised an exenteration under ether, as the ear had been suppurative for years and as the hearing was nil. The patient would not consent to this, but was willing to stand some pain if I could use cocain and curette the soft granulation mass away. Therefore, after cleansing the ear, a cocain and anilin oil solution was dropped in and allowed to remain for ten minutes. I was able to remove quite an amount of this granulation tissue about the opening of the Eustachian tube, but I could not pass probe into tube, yet considerable pus followed its withdrawal. The curette was again brought into use, and more granulations removed. Suddenly there was a flow of about a drachm of pus. As the pain was considerable and the patient somewhat faint, no more was done. The ear was cleansed and a wick inserted. The patient was taken home in a carriage. Following the operation, the patient got marked relief for six days, when in the evening of November 14 there was a distinct rigor, followed by pain in the back and limbs. The throat again began to be very sore. Dr. McDonald cleansed ear and used probe, hoping to give

relief, but got no amount of pus. The following morning
there was visible swelling of the right side of pharyngeal
wall. The patient. fearing that another operation would be
advised, and doubtless hoping to save expense, did not wish
me to be called to the house. During the next night, how-
ever, the swelling advanced very rapidly, there began to be
some obstruction to respiration and there was much alarm.
I was called on the following morning, November 16, and
found that we had a swelling of the pharyngeal wall, much
more marked on the right side. The swelling was very
marked above, the pharyngeal wall being in contact with the
soft palate. The patient was now glad to submit to an anesthet-
ic, but made me promise to make no external incision unless
forced to do so. The breathing was much obstructed, and prep-
arations were made to perform a hasty tracheotomy, if neces-
sary. After beginning ether administration I placed a Mc-
Kenzie forceps back of the epiglottis and then separated
blades. This pressed the abscess wall backward sufficiently
for a freer respiration. The operating table was a kitchen
table, so the patient was placed in a Rose position and the
head turned to the right. The tongue was drawn forward
by a suture passed through it. I first made a small incision
through the pharyngeal wall, a little above the palatal arch,
having first lifted the palate with an elevator. A large amount
of pus was evacuated, and after having pressed out all pos-
. sible, the incision was enlarged by scissors. The forefinger,
passed through the opening, was carried outward and back-
ward and came in contact with bone. A probe now passed
into the ear was easily carried through, and into contact
with the exploring finger. As in the first case, I removed
considerable bone with the small aural curette, and passed
a small perforated tube from the ear into the abscess cavity.
As the pharyngeal opening was made high up, I did not pack
this with gauze, but left it open. The patient recovered from
ether and showed marked improvement immediately. There
was a profuse discharge from the ear for the first forty-
eight hours. The cavity was cleansed by douching through
the ear with a boracic acid solution three times a day, and
the solution entered the throat every time.

November 18. Temperature was only one degree high, patient
seemed better in every way, and was practically free from
pain. The pus began to be less in amount and much thinner.

I did not see the patient again until November 22, for there had been only favorable reports from Dr. McDonald. At this visit, I found the pharyngeal opening closed, and apparently no swelling. There was some soreness upon pressure by the exploring finger. There was only a moderate amount of pus, and we removed the drainage tube from the ear. Orders were given to douche the ear every two hours during the day with warm boracic acid solution. One week later patient came to my office and I was unable to pass a probe anteriorly more than one-fourth of an inch beyond the middle ear. I tried to pass cotton-tipped bougie from pharynx through Eustachian tube, but could carry it only about one-third of an inch into the tube. This led me to believe the tube was occluded. This I found to be the case about a month later. I gave patent a solution of boracic acid and alcohol with calomel to use in ear three times a day. The secretion gradually subsided and was simply of a serous nature at the end of six weeks. I did not see patient again for seven months, when the ear was dry. I could make out none of the ossicles. The hearing was practically nil to air, but patient informed me that she had not heard with that ear for several years. I could not pass bougie nor air through the Eustachian tube.

In the first case, Miss McD. had had a suppurating ear for years before she had the retropharyngeal abscess, and there was a necrotic process extending from the ear to the abscess cavity. Although when I first saw her the abscess was thoroughly developed and I cannot prove that the abscess was not prior to the ear condition, yet with the clear history and the marked necrotic condition of the bone in the anterior portion of the middle ear, together with the advanced condition of the granulation tissues, I am positive that we had an extension from the middle ear.

The second case, developing as it did while under our care, presented no doubt as to the etiology. At the time I met with these cases, I was not aware of the extreme rarity of the condition and was in hopes to meet with more of a like condition. Over five years have elapsed since seeing the last, and I have not seen a retropharyngeal abscess in an adult since. Although, judging by the experience of others, it is doubtful if I see another case in my life, these cases do sometimes occur, and others will see them. For this pur-

pose, I hope this paper may be of value, and also by directing our attention to the possibility of an aural disease extending into and producing a pharyngeal abscess, lead other observers to record the condition of the ears in all these cases. I have been surprised to find that in the reports of so many cases of retropharyngeal abscesses in children, there is so little said in regard to the ears. According to general statistics many of the children reported must have had some co-existing aural disease.

In treating a subject concerning which I have been able to find so little in the literature, and with the personal experience of but two cases, I realize how little I have from which to form conclusions, and such as I present are intended to stimulate discussion, and add new interest to the future study of this subject.

In conclusion, I feel justified in stating, 1st, that retropharngeal abscess in the adult from any cause is a very rare condition; 2nd, that middle ear disease rarely advances forward; 3rd, that when this has occurred, there should be a thorough removal of the granular and necrotic material in the ear, and a free incision through the pharyngeal wall, after which the index finger should be placed in the cavity and act as a guide in using the small aural curette passed through the ear, so as to remove as much of the necrotic bone as possible; 4th, that in the two cases just reported, this proceeding with external opening in the first was followed by permanent relief; 5th, that the external routes of attack are available, and perhaps necessary in some cases; but all of these, with the exception of removing the condyle of the jaw, offer very little if any better opportunity to inspect or attack the bone which is diseased in this particular condition.

REFERENCES.

1 British Medical Report, 1850.
2 New Sydenham Soc. Year Book, 1861.
3 (Transl.) Raccoglitore Med. Torli, 1883.
4 Jahrbuch für Kinderheilk. 1876.
5 Pediatrische Arbeiten, 1896.
6 Laryngoscope, 1903.
7 Annales d. Mal. de l'Oreille, du Larynx, etc. 1904.
8 Glasgow Medical Journal, 1903.
9 Medical Times and Gazette, 1881.
10 Boston Medical and Surgical Journal, 1885.

11 Medical Record, 1894.
12 Text-Book, Lennox-Browne.
13 Archives of Pediatrics, 1879.
14 Archives für Kinderheilk. 1902.
15 Journal of Laryngology, 1900.
16 Monatschrift f. Ohrenheilkunde, 1881.
17 Centrabl. für Chirg., 1888.
18 Archives of Laryngology, 1881.

LX.

THE QUALITIES OF THE SENSE OF SMELL.*

By Dr. H. Zwaardemaker,

PROFESSOR OF PHYSIOLOGY IN THE UNIVERSITY OF UTRECHT.

UTRECHT.

At present, we have three methods of examining the qualities of the sense of smell. The first, which was presented many years ago by Fröhlich,[1] was used successfully by Aronsohn.[2] It consists of causing fatigue of the sense of smell by the use of some odorous substance, and in this condition, it is tested to determine what odors are no longer perceived, what are very faint and what are perceived in the usual degree. Those unperceived are regarded as related to the fatiguing odor. The second method employs mixing conditions and simultaneous compensation.[3] Two odors of weakened intensity are simultaneously used, and it is determined whether they mix or whether they compensate by simultaneous weakening. In the first case, the qualities are regarded as related, in the second as opposed. On this basis, I founded my "Mosaic hypothesis" by joining together in homologous rows the related odor and the peculiarities of clinically demonstrated anosmotics and paranosmotics.[4] The third method is in a way a modification of the second, and will be described in a few words.

From the fact of odor compensation, follows the necessity of representing an odor sensation by means of a vector, i. e., a line in space, whose length and direction is known. The length of the vector corresponds to the intensity; its direction to the quality of the odor. Odors that remain the same in all concentrations (the vast majority) are designated by straight lines; those that change their character with the concentration (antranilic-acid-ethyl-ether, tonor, and many others) by curved lines. Related odors form bundles of vectors; opposing odors, on the contrary, form dispersing vectors, if the vectors are drawn from a common source, a thing which is permissible and even to be recommended.

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*Translated by Clarence Loeb, A. M., M. D.

The mixing of odors it is clear, can be represented by addition of vectors.* If the odors are identical, as e. g., those of camphor and borneol, the vector-sum will possess a direction common to the two original vectors, and a length equal to their combined lengths.

If the odors are related instead of identical, the vector-sum will deviate only slightly in direction and length from that of the above case. Examples of such related but not identical odors are viarvakrol, karvon, safrol and thymol. They mix almost completely, therefore are represented by a bundle of very slightly diverging vectors.

When, however, odors are compensatory, e. g., skatol and kumarin,[5] which, when mixed in certain proportions, almost entirely counteract one another, the vectors either must have an almost completely opposite direction making their sum almost zero, or, better still, in addition to odor vectors, there are assumed to be vectors of loss of odor. In this way, a system of vectors can be drawn giving a graphic representation of qualities of odors. Nevertheless, the hypothesis must still be made that the vectors are active according to the kind of force in the mechanism of resolving them into their component parts. In following out this idea, however, many difficulties are encountered. A prominent one is that one system of vectors will not suffice, and several must be assumed, without their being entirely separated (in which case many modalities could be conceived). Although everything is thus exceedingly complicated, there is yet no reason for refraining from the investigation, which of itself is rational enough. At least, it is partially useful, i. e., for small groups of qualities. A several dimensional complexity, as Wundt calls the system of odorous sensations, never could possibly be simply portrayed, for unfortunately mankind cannot construct solid bodies of more than three dimensions.

I will give examples of the three methods of determining the qualities, and will choose those odors used for measuring

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*To find the sum of two vectors, one is supposed to be moved parallel to itself until its origin coincides with the termination of the other. The line connecting the origin of the first vector with the termination of the second represents the geometric sum. The rationale of the above is easily seen if the vectors are regarded as paths traced by a moving point. It is plain that the point reaches its terminus as well along the vector-sum as along the original vectors.

precision. As I explained in Fränkel's Archiv., Bd. xv, H. 2, the following are serviceable:

1. A solution of nitrobenzol in liquid paraffin........1:20
2. A solution of ethylbisulphid in liquid paraffin.....1:10000
3. A solution of skatol in liquid paraffin............1:1000

In the manner explained (l. c.), the olfactory values of these three cylinders were determined to be as follows:

	Threshold.	Odorimeter Coefficient.	Entire Cylinder Length.
Nitrobenzol	0.010 cm.	100	1000 olf.
Ethylbisulphid	0.005 cm.	200	2000 olf.
Skatol	0.003 cm.	333	3333 olf.

For convenience sake, it was found well to provide the air chamber in front of the olfactometer with a cock at its entrance and exit, and with a firm support. The apparatus then has a serviceable form.*

First Method.

The result of the fatiguing method is very simple. It is seen that fatiguing with either of the odors does not cause fatigue for the other two. According to the Fröhlich-Aronsohn's principle, the three odors belong to different specific energies of the sense organ.

Second Method.

According to the method given in the Physiologie des Geruchs, the odor of nitrobenzol belongs to the second class, that of ethylbisulphid to the fifth, and that of skatol to the ninth. The odors therefore are not related to one another, and in agreement therewith are actually found diminished in different degrees in anosmotics, that is in intracranial or essential anosmotics (the diminution is equal in cases of mild, respiratory anosmia). Examples of this kind are found in the Physiologie des Geruchs and in many other works.

Third Method.

For purposes of simplification, let it be assumed that no qualities of odors exist other than the three used in the clinical precision olfactometry. The question then is: in what way are the vectors grouped in space. It is clear that with the as-

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*The double olfactometer for compensation investigations was made by D. B. Viagenaer, Sr., formerly Amanuensis of the Physiol. Instit.; the olfactometer to be described was made by T. Stellema, the present Amanuensis.
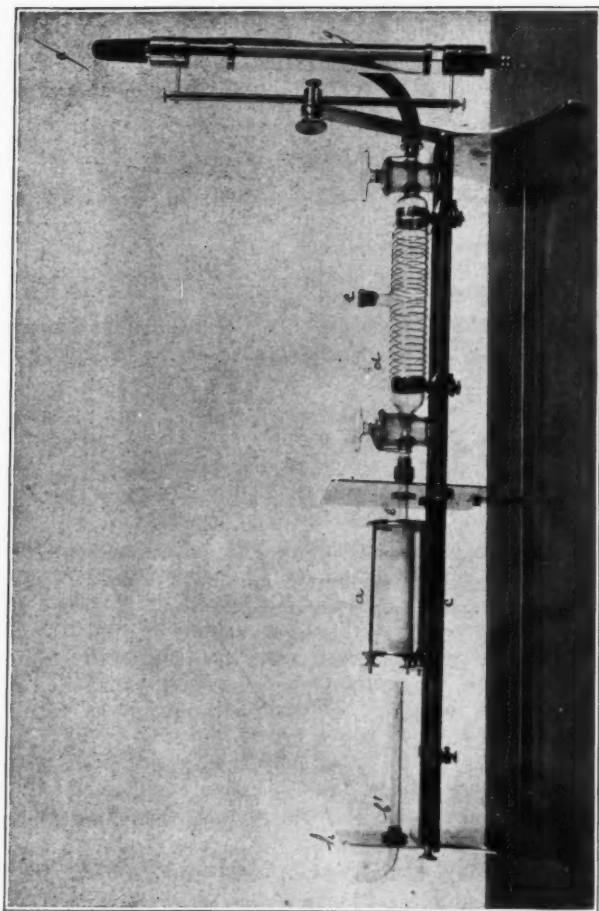
The precision-olfactometer consists of: 1. The magazin cylinder, (a) sliding over an inner tube; (b) along a metal plate; (c) subdivided into centimeters. 2. The air chamber, (d) containing 100 cc., with a cock at the entrance and exit and a smelling tube; (e) closed with a metal stopper. 3. The anemodrometer, (f) consisting of a vertical glass tube containing an aluminium plate suspended between two metal threads, which measures the oscillation of the air current by means of its excursions along a millimeter scale (the anemodrometer is gauged by means of a gas meter). The slight width of the path of the current comprises the magazin cylinder, the cocks and the aluminium plate, 8 mm. N. B. 1. The determination of the threshold of the above solutions is made at room temperature and with an air movement of 8 cc. a second. The gear h. with the second inner tube b¹, serves for approximate determinations.

sumed limitations, there can be only three vector directions; it is possible, however, to use as many directions indicating odorlessness as may be desired.

Let the nitrobenzol odor be represented as a vector whose origin is in the middle of space and whose direction for the occasion is vertical. The length depends on the intensity of the stimulus.

The intensity of the sensation bears a certain ratio to the amount of the stimulus which can be expressed by formulas in different ways. According to Fechner,[6] the formula $e = k.\ log.\ (r-b)$ almost always applies where e represents the intensity of the sensation, k a constant dependent on the quality of the sensation and the psychic condition, r the amount of stimulus and b the threshold value.

According to Plateau[7] the formula $e = a\ r\ k$ fulfills the conditions better, where e represents the intensity of the sensation, a and k constants, and r the amount of stimulus; the constant k of Plateau's formula is always less than 1.

Of these two formulae, the first is the more probable, since Weber's law, according to Gamble's[8] investigations, has been proven true for odors also, and the fact of the threshold can be doubted here as little as in other realms of sense. But the fact of compensation of odors has caused a remarkable approach to the second formula. If p, representing the olfacton of an odorous substance in the air chamber of a precision measure (which in this case must of course be double), and g, representing the olfacton of another substance, when mixed together give loss of odor, I call this annulling of the two sensations, the compensation of their actions. It may be assumed, then, that their actions reach the consciousness in such a way that their resultant force is zero. Many experiments of older and more recent dates have taught that, in general, where p and g olfactons compensate, the same is true of $2p$ and $2g$, $3p$ and $3g$, etc.

The definition of compensation leaves it undetermined whether the compensation takes place between the two stimuli, their action or the sensations. The former, I excluded years ago; the latter demands the correctness of the psycophysic law, which will now be tested.

These results agree with Fechner's formula only under very special conditions. These latter are either that the percentage

with which the stimulis increase causes a distinct increase in
the sensation of equal intensity for both odors, so that $p=g$,
or that both values lie near Fechner's cardinal value.[9] My
method shows compensation of np and ng (when p and g are
increased) far beyond the limits just designated and therefore
opposes an unsurmountable difficulty to the use of Fechner's
formula.

Plateau's formula agrees comparatively well with the meth-
od if the constant k is considered nearly equal to 1. But then
Weber's law is invalid, which according to Gamble's experi-
ments on the sense of smell cannot be true. Therefore,
Plateau's law must be discarded also.

So far as can now be determined, the solution of the con-
tradiction can be made only if it be supposed that, although
the judgment of the strength of the sensation takes place in
the consciousness according to the Weber-Fechner law, the
balancing of the stimulations against one another in compen-
sation is unnoticed and acts apparently according to linear
conditions.

Under these conditions, in the spacial representation of
odors, the vectors may be measured logometrically only if the
sensations alone are considered, and they are to be regarded
proportionate to the olfactory values only if the initial effect
is considered.

As stated, the latter is our object. The length of the odor
vectors are to be the basis of the olfactory values.

To the vertically, upright nitrobenzol vector, a value of 1
has been given in consideration of a certain experiment. After
it has been given an arbitrary length and direction in space, this
can no longer be done for other odor vectors. It is necessary
to calculate the relation of the odor sensations to one another.
The second odor precision measure, for example, gives an
odor of ethylbisulphid, which has the property of entirely
compensating the nitrobenzol odor. The experiment then
shows that 190 olfactons of nitrobenzol $+$ 1900 olfactons of
ethylbisulphid $= 0$.

From this, we conclude that we must give to the vector of
ethylbisulphid such a direction in space that it can be resolved
into two vectors, one of which has an exactly opposite direc-
tion and an exactly corresponding length to that of nitrobenzol,
and the other of which has a direction which may be regarded
as corresponding to one of the many directions of anosmia.

This happens if the ethylbisulphid vector is drawn at an angle of 96° with that of the nitrobenzol. Then, the sum of their actions is zero, and remains zero however it be resolved.

The third clinical odor measure, also, under certain circumstances, compensates the odor of nitrobenzol. The experiment gives:

110 olfactons of nitrobenzol + 3000 olfactons of skatol = 0. According to this, it is necessary to give the skatol vector a direction such that it can be resolved into a vector exactly equal to and opposed to the nitrobenzol and another corresponding to an arbitrary loss of odor. This demands a direction making an angle of 93° with that of the nitrobenzol.

Not only the first and the second and the first and third odor precision measures taken together give loss of odor, but also the second and third. Therefore not only the vectors of ethylbisulphid and skatol have a fixed angle with that of nitrobenzol, but also the angles between themselves is fixed. The experiment shows:

30 olfactons of ethylbisulphid + 3000 olfactons of skatol = 0. From this it follows that the angle between these two is 91°.

The small system* that has been constructed as a result of these experiments evidently consists of 6 vectors, of which 3 represent odors and 3 loss of odor. The 3 odor vectors make fixed angles with one another. Of the 3 vectors of loss of odors, each one is normal to one of the odor vectors and also lies the plane of some other one. No vectors except these 6 exist in space.

Lately, I have used a fourth odor measure for clinical precision olfactometry, whereby a new principle is used. If equal molecular percentages of naphtholin and brom-camphor are mixed at 40° C[10], a substance is obtained which is suited to the formation of olfactometric cylinders. The mass can be at once moulded into the form of a cylinder with a diameter of 8 mm. which can take the place of a magazine in the olfactometer. Only, such a solid, odorous cylinder should be enclosed in glass and covered in front with metal so that the odor of naphthalin may be confined. The brom-camphor-naphthalin

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*It is usual to consider positive the angulation opposed to the movement of the hands of the clock.

cylinder smells of naphthalin, an odorous substance which belongs to the 6th class of odors. Its threshold is 0.0005 cm. Its odorimetric coefficient is therefore 2000. In this unusual intensity of the substance rests a great advantage, because as a result thereof the cylinder may be used in high degrees of anosmia. Consequently, since the eutecticum of a mixture is a very important point from a physical point of view, this solid mixture has lately been used for olfactometry.

Let us try to arrange a place in our vector system for the new cylinder. It can be brought into compensation with the three other precision measures, causing the following equations:

600 olfactons of nitrobenzol +

$$1200 \text{ olfactions of naphthalin} = 0$$

200 olfactons of ethylbisulphid +

$$8000 \text{ olfactons of naphthalin} = 0$$

3000 olfactons of skatol +

$$300 \text{ olfactons of naphthalin} = 0$$

From these equations it follows, first, that the naphthalin vector makes an angle of 94° with that of nitrobenzol; furthermore, that the vectors of naphthalin and ethylbisulphid have an angle of 92°; finally, that the angle between the vectors of skatol and naphthalin is 96°. From an earlier compensation, that between ethylbisulphid and skatol, there resulted another skatol vector which is not identical with the one just described. This cannot be caused by mistakes in the equations, since the variations of the figures cannot be so great that both skatol vectors fall together. With the assumption of 2 vectors for one and the same quality of odor, the rationale of the system becomes destroyed. The delineation of vectors is prevented as soon as it is used for more than three compensating qualities, a fact which is self-apparent, since a many dimensional complexity is then demanded.

We unfortunately have to omit graphic representation when we desire to delineate the relations of qualities of odors to each other if the numbers have to be given and to be arranged under control. Here we will refer to the fraction p-g where p and g represent olfactons ·which compensate in their simplest condition. The fraction states not only that p olfactons of one and g olfactons of the other substances when taken to gether give loss of odor, but also that this is the case with

$2p$, $2g$, $3p$ and $3g$, $4p$ and $4g$, etc. It, therefore, includes all reciprocal relations that can exist between the two odors.

The following odorimetric coefficients belong to the four cylinders which we have dealt with:

Nitrobenzol 100
Ethylbisulphid 200
Brom-camphor-naphthalin 2000
Skatol 333

Each two combined in the ratio p-g gives the following:

$$\frac{\text{Nitrobenzol}}{\text{Ethylbisulphid}} = \frac{1}{10} \qquad \frac{\text{Ethylbisulphid}}{\text{Naphthalin}} = \frac{1}{40}$$

$$\frac{\text{Nitrobenzol}}{\text{Naphthalin}} = \frac{1}{20} \qquad \frac{\text{Ethylbisulphid}}{\text{Skatol}} = \frac{1}{100}$$

$$\frac{\text{Nitrobenzol}}{\text{Skatol}} = \frac{1}{27} \qquad \frac{\text{Naphthalin}}{\text{Skatol}} = \frac{1}{10}$$

The above schema shows schematically very clearly the relations between the qualities of odors studied by us. From this it is clear that spacial representation is impossible. *A fortiori* a plane representation is insufficient. Now the elements corresponding to the specific sensations, the olfactory cells, are found distributed in a plane surface, the mucosa of the regio olfactoria. There must, therefore, be a spacial representation, but it is not actually necessary to represent the abstract relation which we conceive exists between the odors. They find their anatomic substratum only in the very complicated tracts of the central nervous system. Whether, as the "Mosaic theory" assumes, the specific elements of related qualities lie topographically nearer or further from one another, can not be determined *a priori*. Clinical investigations will gradually have to teach us more about that.

REFERENCES.

1. R. Fröhlich, Stzber. Wiener Akad. Mat. Naturw. Cl. VI, 1851, p. 322.

2. E. Aronsohn, Exp. Unters. z. Physiol. d. Geruchs. Inaug. Diss. Berlin, 1886.

3. H. Zwaardemaker, Fortschritte der Medicin, 1889, No. 19.

4. H. Zwaardemaker, Die Physiologie des Geruchs, Leipzig, 1905, S. 255.

5. H. Zwaardemaker, Die Compensation von Geruchsempfindungen. Englemann's Arch. f. Physiol., 1900, S. 423.

6. G. Fechner, Elemente d. Psychophysik, 1860, Bd. 2, S. 13.

7. J. Plateau, Poggendorff's Annalen, 1873, Bd. 150, p. 468.

8. McCulloch Gamble, American Journal of Physiology, Vol. X, October, 1898.

9. H. Wundt, Grundr. d. physiol. Psychol., S. 309 (See also G. Fechner's Elem. d. Psychophys., Leipzig, 1860, Bd. II, S. 49.

10. H. W. Bakhins Rooseboom. Die hetorogener Gleichgewicht vom Standpunkte der Phasenlehre, Braunschweig, 1904, S. 296.

LXI.

THE EARLY HISTORY OF LARYNGOLOGY IN AMERICA.

By Thomas J. Harris, M. D.,

NEW YORK.

The sun shines both upon the just and the unjust; no single territory or country can claim a monopoly of its rays. History has repeatedly shown that no great movement or discovery is the product of any one man's brain. The hero of the moment is but the mouthpiece of numberless generations of searchers and thinkers. Martin Luther did not make the reformation of the 16th century. The times were ripe and he with Calvin and Melanchthon and many an other only gave it expression. Columbus as the discoverer of a new continent was but the victor where many ran. The discovery of galvanism and faradism belongs to no single mind. To this rule the great advances in medicine are no exception.

The celebration in honor of the seventieth birthday anniversary of Professor Bernhard Fraenkel of Berlin, marking as it does the rounding out of a career which is coincident with the history of modern laryngology, is a fitting time to recall what share, if any, America had in the beginnings of that science. The gathering held recently in London, in honor of Senor Garcia, served to impress on us how young this specialty is. To Garcia, a Spaniard, living in England, is accorded the proud honor of being the discoverer of the laryngoscope. Türck and Czermak, of different nationalities, but both living in Vienna at the time, contested the title of first employing it in medicine.

What share was our own country taking in these strivings and seekings while still "rosy fingered Dawn" filled the laryngological sky! To the older members of our cult there is no need of rehearsing this tale. The graphic account of Elsberg is still fresh in their minds. But, alas, the ranks of those who heard Elsberg is ever growing thinner. Since that day a new

generation of laryngologists, mighty in number and boasting in the strength of their youth, has arisen, to whom this story is a dim tradition or an unread tale.

Let it be said, then, that America's share in this development is one which can be pointed to with just pride. Keen minds on this side the water were pondering over the same problems which confronted Türck and Czermak.

Living in Woburn, Mass., at this time was a young physician, a graduate of Harvard, who had busied hmself with a solution of the problem how to see the larynx by means of prisms. After much study he submitted his ideas to G. B. Clark of the firm of Alvah Clark & Sons, the celebrated lens makers of Cambridge, Mass., with the request that he construct an instrument according to the drawing. This with certain necessary modifications, Clark did in the year 1857, as is shown by the correspondence which passed between them and which was later published by Elsberg. Cutting afterward moved to New York City, where he is still living. While this arrangement of mirrors was, as far as we can learn, never actually used, it is of no little interest to know that such work had been done by an independent American mind.

Cutting's work was theoretic. For many years antedating him, the true pioneer in laryngology in this country had been daily treating diseases of the larynx by the same measures we employ today. The name of Horace Green will ever stand as the father of American laryngology. Few men in the medical profession have been more bitterly assailed. He, like many another pioneer in the fields of truth, was in advance of his generation, and ridicule and calumny were his lot. More fortunate than the majority of that class, it was his happy fate to live to see his claims vindicated.

Green was born on Dec. 24, 1802, and died Nov. 29, 1866. After graduating in medicine, he settled in Rutland, Vt. In 1835 he moved to the City of New York. He was one of the founders of the New York Medical college, of which he was president, and where for a long time he occupied the chair of medicine.

He received many honorary degrees, including that of LL. D. from the University of Vermont. He continued to practice his specialty till shortly before his death. His biography speaks of his being endowed with a strong religious sentiment.

Throughout the long years of controversy in which he was engaged, he succeeded in retaining the confidence and friendship of the leaders of the profession in New York.

Green in 1846 brought out his Treatise on Disease of the Air Passages. In this he claimed to cure diseases of the larynx by direct applications of varying solutions of nitrate of silver, introduced upon a sponge with a curved handle. He states that he first did this in 1838, shortly after his return from a year's visit to Europe. The idea of employing direct medication, he ascribes to a conversation with an English physician whom he met while abroad, and disclaims adopting it from Trousseau and Belloc. His was the first treatise on laryngology published in America.

The publication of Green's book provoked intense opposition. As he says, for many years he refrained on this account from again asserting his views. In 1857, however, he once more set them forth in a paper read before the New York Academy of Medicine. In this paper he claimed to be able not only to introduce instruments into the larynx, but also into the bronchi, and asked for a committee from the Academy to be appointed to investigate his claims. This was done and under the chairmanship of the celebrated Valentine Mott it reported that while the latter part of his contention lacked sufficient proof, in the main his claims were just.

While Green stands forth as the one conspicuous laryngologist of the first half of the last century, others of his countrymen had shown their interest in this special field of science. Cheesman, in 1817, described in detail a laryngeal growth. In 1828 Physick, of Philadelphia, published a description of the tonsillotome which bears his name. Before that time it was customary to put a ligature upon the tonsil and allow it to remain for several days. In 1828 Matthews devised another tonsillotome, and in 1832 Fahnestock, of Lancaster, Pa., described one which closely resembles the present Matthieu's.

Acute and chronic laryngitis, which are wont to present to us no symptoms of gravity, were to the men of that day among the most deadly of diseases. The literature of those years is full of reports of a suffocative form of laryngitis usually fatal which is rarely met today. It was in its chronic form, held to be almost invariably tubercular in origin. Green published in 1858 the fourth edition of his work, as well as in 1852 one

on the Treatment of Polyps in the Larynx. Here he shows a number of instruments and reports several cures by intra-laryngeal removal.

In 1858 Czermak published his first paper on the laryngo-scope. Two years later Dr. Hugh Strangenwald read a paper before the New York Medico-chirurgical Society describing it. March 6, 1861. Dr. Wm. H. Church presented the sub-ject at an interesting meeting of the New York Academy of Medicine. On that occasion Dr. Ernest Krackswizer asserted that in all probability he was the first person to use the laryn-goscope in America. He used a reflector devised by Semeleder, an assistant of Czermak. Among others, Horace Green was present and reported his experiences, with the new instrument. What a memorable evening for that battle-scarred old warrior! How proud he must have felt to hear his contentions of a life-time, after meeting allegations of the gravest character, fully justified!

If Green was the prophet proclaiming out of the darkness, the coming of good things laryngologically, the apostle who announced the actual dawn of it was the lamented Louis Els-berg. By common consent Elsberg more than any one else was the leading figure in making laryngoscopy and all repre-sented by it, popular with the profession in this country.

Elsberg was born in Westphalia in 1837. He came at an early age to this country and graduated in 1857 from the Jef-ferson Medical College in Philadelphia. About 1861 he re-turned from Europe, where he had seen Czermak's work, and settled in New York City, where he at once began to preach the new doctrine of laryngology. During the years 1861-4 he published several papers on this subject as well as addressing the New York Academy of Medicine. To him belongs the honor of giving the first instruction in laryngology in America, which was in 1861 at the Medical Department of New York . University. Two years later he established the first laryngo-logic clinic in this country in connection with the same insti-tution. Others followed in Elsberg's footsteps soon, among whom was the distinguished J. Solis-Cohen of Philadelphia, who still survives. The speciality grew with such strides that in 1873 the New York Laryngological Society was founded, the first of its kind here and possibly in the world, and in 1878 a number of those interested in the subject met in Buffalo

upon the invitation of Dr. Frank H. Davis, of Chicago, and organized the American Laryngologieal Association. The first meeting of this society was held in New York City under the presidency of Elsberg in 1879. At that meeting, he delivered the address from which much of the material of this paper is obtained. Joined to the paper was a complete laryngological bibliography from early in the century to the year 1879.

In the less than twenty years which followed Elsberg's first lecture and clinic, the specialty spread so that at the time of his inaugural there were 25 universities and colleges where special instruction was given in laryngology in 1879.

Elsgerg died from pneumonia in 1885 at the age of 48. In a biographical sketch written shortly after his death, Delavan speaks not only of his high scientific attainments but of his strong social nature and charming personality. John H. Douglas, Lincoln, Seiler, Allen, Jarvis, Daly, Asch and Davis followed Elsberg one by one. The majority of those, however, who stood shoulder to with him, are still alive, and actively engaged in professional work. The amount of valuable scientific work they have done in these last twenty years is known abroad as well as here, and the names of Cohen, Bosworth, Shurly, Ingals, Roe and Lefferts among others will long be remembered as among those who did most to put laryngology upon the high plane which it at present occupies.

LOUIS ELSBERG, M. D.
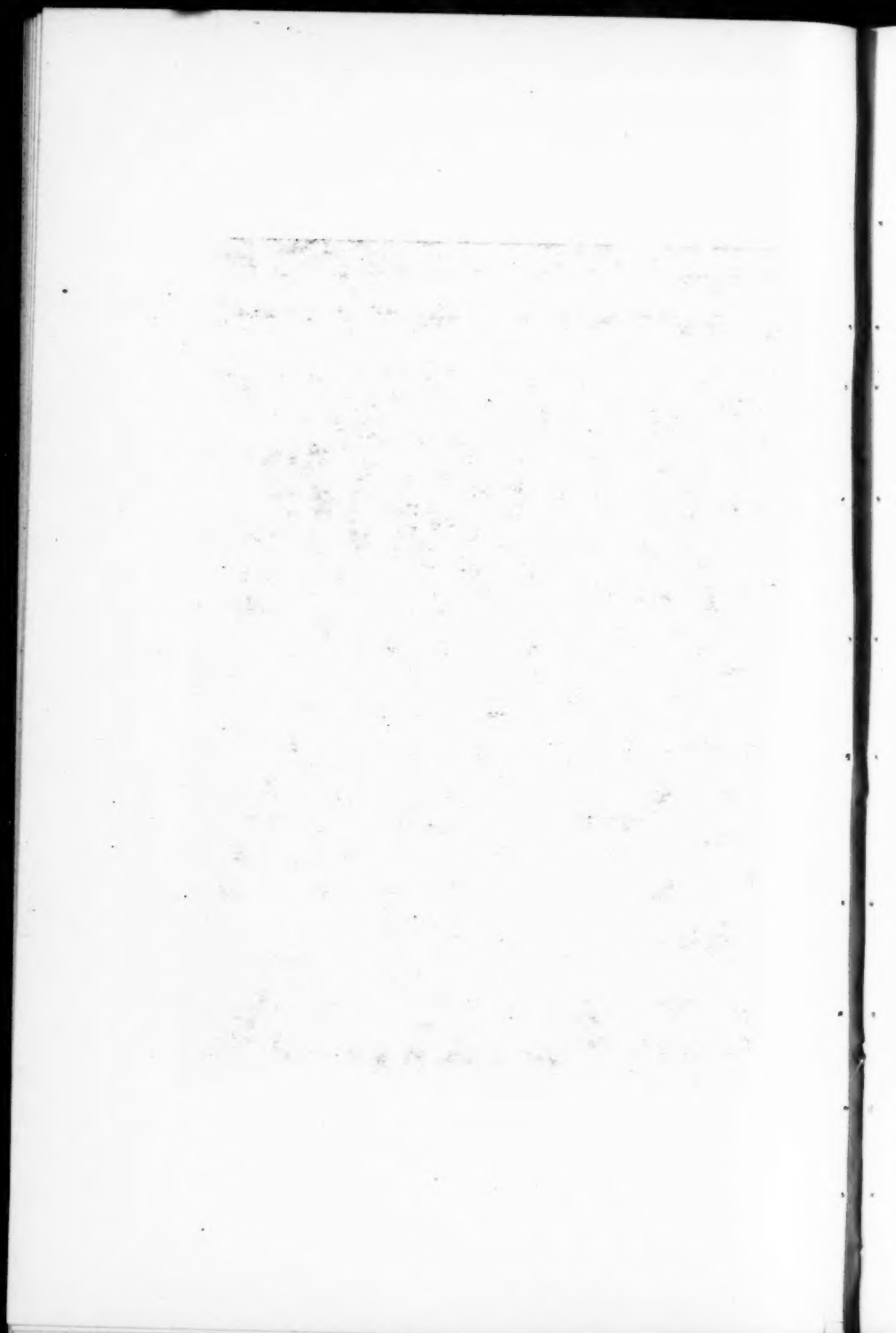
EPHRAIM CUTTER
M. D., Harvard, 1856 and U. Penna 1857.
M. A., Yale, 1855; LL. D., Iowa College 1887.
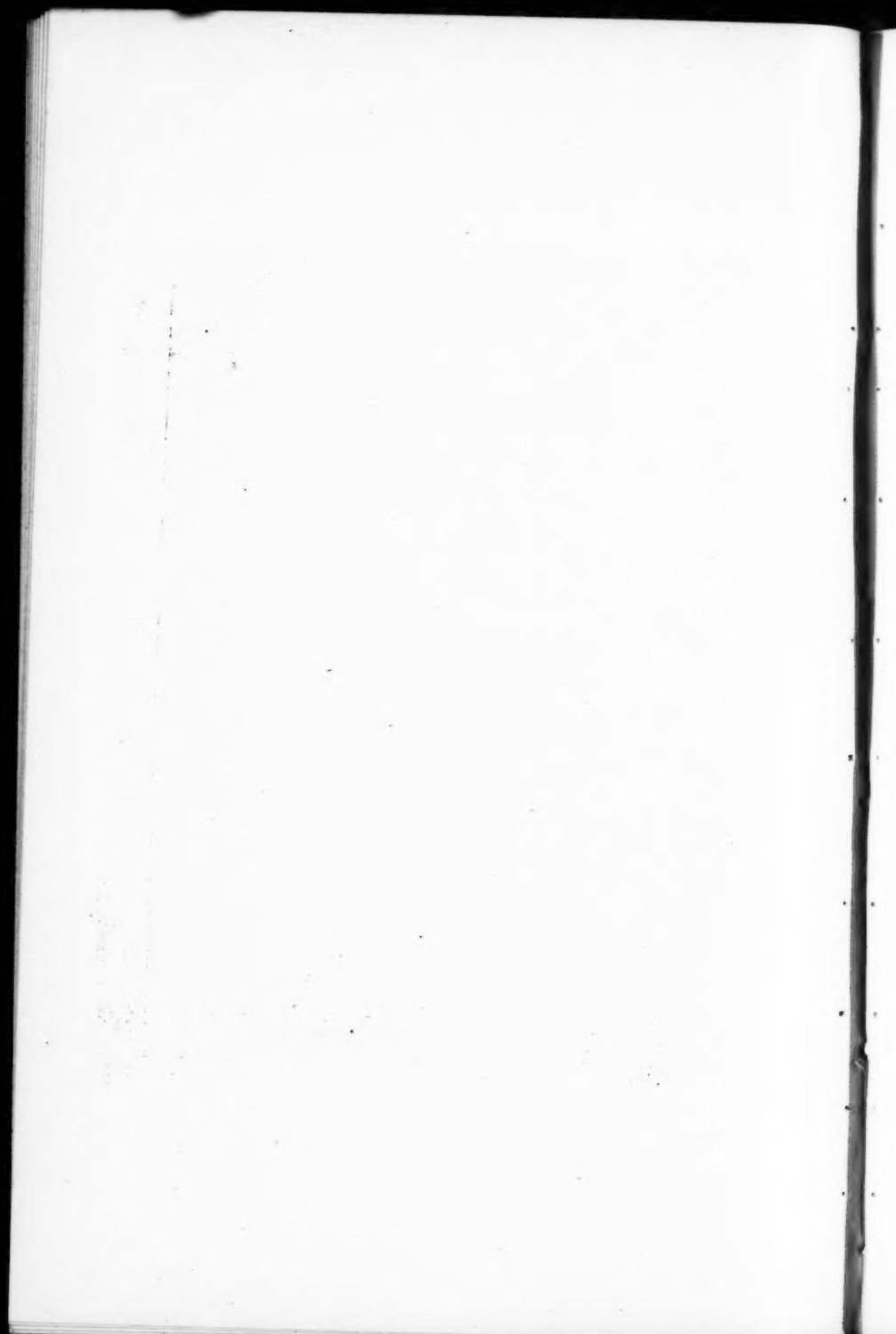
LXII.

REMINISCENCES.

By Ephraim Cutter, M. D., LL. D.,

WEST FALMOUTH, MASS.

I remember calling on Horace Green at his office. He was a very pleasant man. With reference to the patient about whom I consulted him, he said that I had passed a sponge probang with nitrate of silver into his trachea. As I could not see, I could not determine the matter for myself. It was probably as he said, but my experience at that time made me think that it might have been the esophagus.

Later, in Vienna, Semeleder showed me the three valves of the larynx in action on himself.

In 1865 I became acquainted with Louis Elsberg, the father of American laryngology. The Massachusetts General Hospital at Boston had sent a Mr. Capen to me at Woburn, Mass., for diagnosis. I wrote simply what I saw. They sent him to Elsberg, who had written a prize essay on Throat Diseases and Laryngeal Growths. Elsberg was delighted with my report because I did not state that it was cancer but gave the characteristics as I found them. He said this was the best way to do.

Elsberg was of great inventive genius—an honor to his profession. He was one of the best electricians that I have ever met.

We studied up together things connected with laryngology and it was delightful to us both to see each other's inventions. It was a sad day for the profession when his sun set in medical glory; a great gap was made in my medical life when he was removed. His technic and tactile gifts made patients like to be treated.

Dr. J. Solis-Cohen, though still living to bless the world, should be mentioned. He and Elsberg were like Damon and Pythias, one in New York, the other in Philadelphia. It was a delightful time for me when they came to Woburn to assist in my operation for removal of growth by thyrotomy without

the tracheotomy tube. Some of these cases were very interesting. The first, operated upon in 1866, was without recurrence for 20 years. Another patient in whom new vocal bands were made by scissors, recovered phonation.

In the course of my long experience with laryngology, I have made the following observations:

1. Enlarged fibroid arytenoid cartilage, cured by scarifications with a knife made for it.

2. Ulceration in the pyriform fossa often causes cough.

3. Pharyngitis sicca easily cured by drinking, 4 pints of hot water one hour before each meal and before going to bed.

4. Adenoids just behind the middle of the lateral pillars of the soft palate are often the cause of throat trouble.

5. Breath bands are to be preferred to false vocal bands because they control expiratory breath.

6. A young lady studying for the opera in London could not reach high C. Treatment of the vocal bands was without avail. An adenoid was treated with liquor ferrous sulphate, U. S. P., and she recovered this note.

7. Uterine disease will cause throat troubles.

8. A right and left Eustachian catheter, shown at the International Congress at Moscow, conforms to the natural angles.

9. Speech and song differ entirely in the length of the basic vowel sounds.

10. Thus phonation is subject to musical laws.

11. Hence phonation should be in the chord of the keynote of audition.

12. Music and speech belong to the spiritual kingdom of food.

13. Tremolo singing of sacred music is unlaryngologic and indicates partial paralysis of the vocal cords.

14. Laryngologists would do well to lay down laws of speech and song, because speech and song are functions of the larynx belonging to its physiology.

15. Speech and song are most wonderful things laryngology has explained better than anything else. They are treasures of the air, all but priceless. They are precious gifts of God worth more than gems and gold. Languages and tongues in Holy Writ are seen to come directly from the Creator.

16. I can only add that in 1850, I had a most earnest desire to see my own larynx, *in situ naturali.* I had heard of Garcia's

invention; I sought for it in the armamentarium of medicine, but could not find it. I had to invent for myself. I took a microscope as a pattern, made drawings and explanations to Alvah Clarke and Sons, the makers of the largest telescope, and they constructed a laryngoscope for me in 1859. I did but little with it.

I saw Czermak at Paris in 1862 demonstrate his own larynx. I also viewed the photographs of his larynx. He said that he could not get the thyroid insertion. After this I had my tin-smith construct my laryngoscopes out of tin and mirrors. They were successful.

In 1866, I photographed my own larynx and was fortunate enough to finish Czermak's work as to the anterior insertion. Copies are in the U. S. Army Museum, Washington, D. C.

17. The general condition of the system should not be forgotten. The Almighty within us is trying to cure us of our physiologic virus. So it is of importance to see that the system is well fed and cared for as to the mineral, animal, vegetable and spiritual kingdoms.

LXIII.

CONTRIBUTION TO THE ETIOLOGY OF ATROPHIC RHINITIS.

(RHINITIS ATROPHICANS SIMPLEX ET FOETIDUS SEU OZENA.)*

By Dr. John Sendziak,

WARSAW.

Atrophic rhinitis is among the more common forms of chronic rhinitis, as I have found the disease 1142 times in about 20,000 private and dispensary patients (642 dispensary and 500 private), more than 5½ per cent. Of these cases, 782 were of the simple variety and 360 of the fetid or ozena, making the proportion 2 to 1.

Krieg of Stuttgart states that the fetid form is much more frequently found, which we must assume to be due to the local conditions in Germany, as Jurasz of Heidelberg also found ozena more common than the fetid form (170 to 45).

In Jurasz's clinic the cases of atrophic rhinitis numbered 215 out of 4000, or about 5 per cent.

My figures show that the disease is more prevalent in the poorer classes, viz., dispensary patients; the relation being 642 to 500, or 6.5 per cent to 5 per cent—there being about 10,000 patients in each service.

Out of 1616 cases of chronic rhinitis, 1142 showed evidence of the atrophic form (782 simple and 360 fetid) and 1048 of the hypertrophic variety.

The statistics of Jurasz differ somewhat from these. He found atrophic rhinitis in 215 cases (45 simple and 170 fetid) and hypertrophic 400, almost twice as many. It is striking that Jurasz found the hypertrophic form the most commonly while I found it least frequent. All this is probably dependent on the local conditions of the countries in which the observations were made.

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*Portion of a large monograph to be published later.

All writers agree that the disease is found more frequently in females than in males (Hamilton, Bresgen, Grosskopf); according to Schaefer one and a half times more; Gerber in 71 per cent of the cases; Michel twice as often and Jurasz almost twice as often (140 to 75). Krieg reports a still larger percentage, 94 to 44, and Höffler and Wyss still larger, 4 to 1. Voltolini holds that the disease is pathognomonic for women.

My own cases differ fundamentally from those just given, although I have also found the disease more common in the female than in the male, especially the fetid form. My figures were 574 females and 568 males. Only one observer, Schmiegelow, of Copenhagen, gives a similar finding, i. e., about equal for the two sexes. Again we must ascribe to the different local conditions this large difference in the sex of patients suffering from the disease. Of the 574 women, 330 were married, 204 not married and 40 widows, which would indicate that married women are particularly predisposed to atrophic rhinitis, especially of the fetid form. This fact probably finds an explanation in the presence of diseases of the genital organs.

A striking fact in my observations is the exceedingly frequent occurrence in the fetid form of the disease in Jews (232 out of 1142 cases, about one-fifth), proving that this race is specially predisposed to this disease, possibly due to the unhygienic conditions under which the people of this race live. I have not found that other writers on the subject have noticed this fact.

The following shows the ages of patients affected:

Between 5 and 10.......... 58
       10   20..........272
       20   30..........314
       30   40..........230
       40   50..........134
       50   60.......... 78
       60   70.......... 38
       70   80.......... 12
                          ____
                 Total...........1142

It thus appears that the disease occurs mainly during the period of sex maturity (from 10 to 20) and still more frequently between 20 and 30 years. This is also shown by Jurasz, who however found that the disease was most fre-

quent between 10 and 20 and slightly less between 20 and 30 years of age. He very properly considers that it depends upon the various disturbances which usually occur at this period of life, especially chlorosis in girls.

The youngest of my patients was 9 months of age, which would tend to show that the disease may be hereditary. Valentin and Kayser accept this as the only explanation of the origin of the disease; Schmiegelow does not agree with this view, having found two cases which began at the 34th and 28th year. Roe found the disease always in children and Riviere in 10 per cent of the cases. At any rate my statistics show that no age is exempt from the disease, even the most advanced (12 cases between 70 and 80 years).

Krieg and Grosskopf very properly state that the disease may occur in the rich as in the poor, in the latter more commonly. Voltolini opposes this view.

The disease was found in girl pupils 52 times, maid-servants 32, governesses 16, and seamstresses 12.

Krieg found ozena mainly in girls in orphan asylums, maidservants, girl pupils and seamstresses and more rarely in press women, ballet dancers, telephone operators, etc.

In males the following are the occupations:

Merchants	70	Tanners	6
Pupils	68	Coal men	4
Land owners	66	Hatmakers	4
Civil officers	56	Notaries	4
Priests	34	Mechanics	4
Boys, school	28	Technologists	4
Military officers	24	Booksellers	4
Physicians	22	Directors	4
Teachers	20	Carpenters	4
Bookkeepers	12	Butchers	2
Clerks	12	Literary men	4
Administrators	10	Masons	4
Apothecaries	10	Brewers	2
Locksmiths	10	Watchmen	2
Boarding house keepers	8	Cashiers	2
Confectioners	6	Musicians	2
Engineers	6	Gardeners	2
Manufacturers	6	Draftsmen	2
Attorneys	6	Telegraph operators	2
Boatmakers	6	Bakers	2

Coachmen	2	Tailors	2
Foresters	2	Geometricians	2
Machinists	2	Judges	2
Soldiers	2	Painters	2
Laborers	2	Policemen	2
Restaurant keepers	2		
Wards	2	Total	568

The above figures agree with those of Krieg, which show that atrophic rhinitis, especially ozena, is more common in merchants and male pupils and then in land owners, civil officers, physicians and teachers.

The striking frequency of simple and fetid atrophic rhinitis in school children is explained on the basis of the disturbance of the general condition (anemia, chlorosis and scrofulosis), and upon the intellectual work done and other causes, especially of a sexual nature. The frequent occurrence in merchants and civil officers is probably due to the continual respiration in shops and in places where they devote themselves to their profession. It is striking, however, that the disease is met so uncommonly in apothecaries. It is also very difficult to explain why the disease occurs so frequently in land owners who live under favorable conditions.

The etiology of simple as well as fetid rhinitis has not been absolutely solved. We know only that the following are the important predisposing causes:

1. Trauma which was observed 8 times by me (twice in 215 cases by Jurasz). It generally occurs in childhood when the child first begins to walk, or later following a blow on the nose. As indirect trauma, there was first deviation of the septum and then chronic atrophic rhinitis or ozena.

The disease may occur after operations on the nose, especially resection of the turbinates. Such a case was observed by Stewart. Palse observed a case of typical ozena in an anemic woman following galvano-cautery operation on the inferior turbinate.

In the main I consider that illadvised local treatment of nasal stenosis, which has been so prevalent of late, may act in a negative sense upon chronic rhinitis, resulting in the simple or fetid form of the atrophic variety. John Mackenzie calls attention to this.

2. Acute infectious diseases play a very important role as a

predisposing cause. The most important are influenza (16 times in my cases), diphtheritic croup (4), typhoid (4) and smallpox (2). Thomson also observed one case following typhoid, and Jurasz mentioned scarlatina (2 cases), measles (1), and erysipelas (1).

3. General pathologic processes such as chlorosis and anemia (56 cases), scrofulosis (112), and tuberculosis (84 cases, in 24 of which the larynx was involved). Jurasz noted the occurrence of anemia and scrofulosis very often.

The mutual relation between tuberculosis and atrophic rhinitis is very important. Brindel, for instance, believes that ozena unquestionably predisposes to tuberculosis. Pluder, Swain, Grünwald, Theisen, Freudenthal, Siebenmann and Wyss agree in this opinion. Our figures show that this is true by the co-existence of these two diseases in many cases. Hamilton observed 6 cases of tuberculosis in 170 of ozena, Harris in 50 per cent of the cases, and Wyss in more than half. Clark maintained that ozena occurred in more than half of the cases of tuberculosis of the larynx; with this view Hubbard and Newcomb did not agree (the latter author did not find ozena present in 70 cases of tuberculosis). In the 1142 cases of atrophic rhinitis which I have observed, tuberculosis was present 84 times or in 7.4 per cent of the cases. In my opinion there is no doubt that there exists between tuberculosis and ozena a causal relation which is also found in relation with anemia and chlorosis, besides the ozena may cause the development of a tuberculous process, which Krieg regards as more frequent.

Siebenmann's case proves this: A man 21 years old was affected with ozena for 15 years and with tuberculosis for two years. I also observed a similar case: A girl, 17 years old with a typical recent ozena, accompanied with frequent expistaxis, developed an acute attack of pulmonary tuberculosis (phthisis florida) with fatal issue, while under my care.

Some authors (Leiss, Watson) identify ozena with lupus (erythematodes). Syphilis is undoubtedly to be numbered among the predisposing causes of atrophic rhinitis; it was found 114 times in my cases, about 10 per cent.

Jurasz also found this disease commonly among his cases (13 times in 170). The following writers ascribe to this disease an etiologic significance: Stoerk, Hoeffler (hereditary lues), John Mackenzie, Gerber and Thost. Rundström on the contrary denies it.

Among the other pathologic processes which have a predisposing influence in the causation of atrophic rhinitis, I must mention obesity (24 cases), uric acid diathesis (30), neurasthenia and hysteria (48 and 36 respectively). The latter may be the result rather than the cause of the condition.

4. Tobacco is also an etiologic factor. I found it 120 times, about 10.5 per cent. Very little attention has been paid to this. Overuse of alcoholics was also found relatively often (40).

5. Pathologic conditions of the genito-urinary apparatus are important predisposing causes. Most important are the changes in menstruation (amenorrhea, dysmenorrhea and menorrhagia) of which I noticed 8 cases, climacterium 8, pregnancy 16, nursing 12, and metritis 4. A common proof of the causal relation existing between these two is the well-known lessening of the disease during menstruation. Masturbation was quite commonly (8) found in both sexes; I ascribe to it a predisposing role in the development of the disease.

6. General pathologic processes. Bright's disease was observed 8 times in my cases. It is well known that pharyngitis sicca which is an almost constant accompaniment of atrophic rhinitis is to a certain degree pathognomonic of the disease. Heart disease was noted 4 times, angina pectoris 4, paralysis agitans 2, pleuritis 2, cystitis 2 and actinomycosis 1. Two cases were idiots.

The questions of diathesis and contagiousness are important. Diathesis is undoubtedly influential in causing the disease; its simultaneous appearance in parents, children, brothers and sisters is evidence of this. In my cases, the disease occurred simultaneously in mother and daughter 5 times, both parents and children 4 times and in brothers and sisters 10 times. Such cases are well known in literature (Rosenfeld, Loewenberg, Paulsen, Strübing, Stoerk and Krieg).

My statistics are specially important as to the diathetic relation of mother to daughter.

At the beginning of the seventeenth century Crat was of the opinion that it was contagious. In more modern times, the opinion is held by some, especially Capart, while Brügelmann and Hamilton deny it.

Up to the present time, we have no positive proof of the contagiousness of the disease, yet autoinfection is indicative

(involvement of the larynx and trachea without the pharynx being affected).

Strübing inoculated the discharge from ozena on the mucosa of a healthy nose in a tubercular patient. Death followed in four weeks. Macroscopically crusts were found, microscopically special bacilli.

Lately Perez from minute bacteriologic investigation comes to the conclusion that infection is possible from dogs as well as men.

There are various theories of the cause of atrophic rhinitis which have their adherents and opponents. The more important are:

1. Hereditary, constitutional, and Bosworth's theory.
2. Mechanical (turbinated bodies, etc.).
3. Focal (lateral sinus theory).
4. Chemical.
5. Trophoneurosis.
6. Parasitic—the most important and best.

1. **Zaufal** first drew attention, in 1874, to the wide nasal cavities as a congenital cause of ozena, while the hereditary influence was maintained by Hopmann (shortness of the nasal septum), Rosenfeld; congenital atrophy of the turbinate, Kayser, Valentin, Hill, Somers and Shrimunsky.

Trousseau's constitutional theory is one of the oldest, and was supported by Capart. It is based on the fact that atrophic rhinitis is the result of constitutional diseases (scrophulosis, tuberculosis and syphilis) hereditary and acquired. Above all, syphilis seems to play the most important role, an opinion supported by Fabricius Ab Acquapendente, in the middle ages, and in more modern times by Stoerk, Gerber, Schaeffer, who found 20 syphilitics (2 hereditary) among 119 cases; Schroetter, who found 34 out of 77 cases; Mackenzie 3 of hereditary and 3 congenital and Jurasz 13 out of 170.

In addition, John Mackenzie and Thost even now ascribe to this disease an important influence, while Rundström and Gottstein are of the opposite opinion. The latter found no cases in his practice.

I found syphilis in 114 out of my 1142 cases (10 per cent), so I consider that syphilis is of importance in the etiology.

Scrofula is also an important predisposing cause of atrophic rhinitis. Schaeffer observed the disease 99 times in 119

cases, Schroetter 10 in 77, Gottstein 2 in 12, Jurasz 7 in 170, and it was found 112 times in my 1142 cases (about 10 per cent).

I have already mentioned the relation of tuberculosis to atrophic rhinitis. As to the simultaneous ocurrence of the two diseases, I noted it 84 times in my cases, 7.4 per cent, so the relation between the two cannot be denied. Brindel, Plunder and others are of this opinion. Stoerk, Schmidt, Krause, Bresgen and Watson ascribe to gonorrhea some significance in the etiology of the disease.

2. Most authors, such as John Mackenzie, Gottstein, Schaeffer, Moure, Flesh, Williams, Hajek, Compaired, Clure, Schech, M. Schmidt, Watson and Waterman believe that atrophic rhinitis always results from hypertrophic. My experience confirms this, for I found it present 60 times.

Others oppose this view, particularly Mulhall, B. Fraenkel, Wyss, Hopmann and Roth. Walb claims that the atrophy is due to the presence of the crusts.

Zaufal, regarding the affection as congenital in character, maintains that on account of its capaciousness, the nasal cavity, loses its property of removing the nasal secretion in proper suitable quantities, wherefrom the nasal mucus becomes thick and on account of the bacteria acquires a bad odor (fetor). Saenger, Barth, Brügelmann, Aysagner, Catmatter, Campes, Salles, Todenat and Rouge support this view and likewise Demme, who draws attention to the perpendicular position of the nose in patients suffering from ozena.

Heymann explains this condition somewhat differently: the inspired air passing through preternaturally wide nostrils is not sufficiently warmed or moistened, and on account of this the dryness and interference with secretion cause the bad odor.

On the other hand, Sauvage and Fillet hold that the narrowness of the cavity is responsible. Hopmann, concludes that the nasal septum is much shorter anteroposteriorly in cases of genuine ozena, based on numerous measurements of the length of the septum and width of the epipharynx. He agrees with Zaufal, of course, that the affection is of congenital origin; in this Grünwald does not agree.

Recently Berliner maintained that the principal cause is the adhesion of the anterior part of the middle turbinate to the septum in cases of abnormally narrow nasal cavities. This causes a stoppage of the secretion in the superior part of

the nose with all its consequences (fetor, etc.). This theory, however, found no supporters. On the contrary, it is denied by Kayser and Demme.

In some of my cases, where this condition existed (septum always deflected), the symptoms of the atrophic rhinitis were more expressed on the opposite side, which naturally is in opposition to Berliner's theory.

To this category, at least in some degree, belongs the theory of Bosworth (1900), according to which the disease is a result of purulent rhinitis of childhood. "Children are very predisposed to the inflammatory catarrhs; the first result is increased secretion. The process spreads slowly into the glandular tissue, the secretion becomes thicker and dries in the form of crusts which by pressure repress the blood flow to the mucous membrane. The dry secretions are not expelled, decompose themselves and cause the characteristic smell (fetor)." The opinion is shared by American and English writers such as Richmond MacKinney, L. Lack, Spencer and Brenner.

3. As I have stated in the introduction, the opinion was still held at the end of the seventeenth century by Vieussens, Reininger and Güns, that ozena was not a separate disease but a symptom in suppurative disease of the lateral sinuses of the nose. In more recent times, this opinion is gaining ground. Michel and Schaeffer noted that ozena disappeared after cure of sphenoid sinus suppuration.

The principal exponent of this, the so-called focal theory, is Grünwald of Monaco, who maintains that ozena is always caused by suppurations of the lateral sinuses of the nose, especially the ethmoid and sphenoid. The following favor this view: Bresgen, Nöbel and Löhnberg, Hajek, Wertheim (autopsies), Moll, George, Ryerson, Porcher, North, Winslow, Jacques, Theisen, Mayer, Logan, Farlow, Langmaid, Chatellier, Grant, Berthold, Cobb, Ricord, Brieger, Cassel, Robertson, Flatau, Spicer, Tissier and Harris.

Most of these authors regard ethmoid and sphenoid disease as the cause of ozena. Langmaid and Flatau observed recovery follow operation for empyema and caries of the sphenoid and ethmoid sinuses. Others hold that it is diseases of the maxillary sinus that is the cause. Robertson and Spicer had recoveries following operation for empyema of the maxillary sinus.

Brenner found the sphenoid affected once and the maxillary twice in twenty-five cases, and Harris in nineteen cases found the maxillary affected twice and the ethmoid once. Ricord found only the frontal affected

On the other hand, this theory is opposed by Schech, M. Schmidt, Rosenthal, Wright, Mygind, Zarniko, Hill, Rethi, Jacoby, Hopmann, Gerber, Kafemann, Cholewa, Cordes, Zuckerkandl (anatomic grounds), Habermann, Siebenmann, and Grosskopf (two cases without sinus involvement cured by other means).

I do not consider that disease of the accessory sinuses is the cause of either simple or fetid atrophic rhinitis, although I found it present in relative frequency; 86 cases, in 40 of which the maxillary was affected. Furthermore transillumination and other tests were negative in 290 cases.

4. Krause first showed, in 1885, that the principal feature of the disease was to be found in the changes in secretion, namely, fatty degeneraion of the infiltrated cells, hence fetor. E. Fraenkel also maintains that the principal factor in cases of ozena is the atrophy of Bowman's glands, whence the penetration of microorganisms is facilitated, causing fetor. Schoenemann, Grosskopf and Moure hold this view.

According to Habermann, the cause lies in the fatty degeneration of the epithelium of Bowman's glands, as well as of the acinous glands. Rethi and Roe believe in this theory, likewise Jurasz, who regards ozena as an anomaly of secretion. Freudenthal regards xerosis (i. e. lack of humidity) as the most important factor, while Sanger believes that it is the diminution (5 to 10 times) of the tension of the expiratory oscillation of the air pressure.

5. The first Volkmann, and afterwards Suchardt showed that the change of the cylindrical epithelium into the flat corneous (the so-called epithelium metaplasia) plays a very important part in the etiology of ozena, fetor being dependent on the decomposition of the corneous substance of the cells. Seifert and Zarniko maintain this opinion, the latter however thinks that the participation of the specific bacterium is necessary. Bayer, Hecht, Capart, Sautmann, Gougenheim, Rethi, Mygind and Bouronilleé hold to the trophoneurotic theory.

Siebenmann introduced in 1900 some modification of this theory on the basis of the mechanical theory, i. e., Suchart's metaplasia, the so-called chemaprosopia (wide face and nasal

cavities). Holinger Meisser and Grossherntz suport this view.

Gerber, in 1900, basing his views upon special investigation of 407 cases of ozena, became convinced that chemaprosopia and platyrrhinia (wide face and wide skull) play the most important role. Cholewa and Cordes regard as the cause of ozena the primary changes in the bones (atrophy) analogous to those we see in osteomalacia.

6. The parasitic theory best explains the conditions found in atrophic rhinitis.

The first bacteriologic investigations in ozena were made by E. Fraenkel in 1882. He found two kinds of micrococci and bacilli, regarding one of these (the thick bacillus) as the cause of the fetor. Three years later, Loewenberg of Paris succeeded in cultivating a special form of microorganism which he claimed was specific for ozena, having found the diplococcus (diplobacillus) generally in the form of chains in 16 cases. Besides this ozenacoccus he found two other forms of bacteria. Inoculation, however, was negative.

B. Fraenkel proved the results of E. Fraenkel, but did not acknowledge the specificity of Loewenberg's microorganism. On the other hand, Sicard, Fuge, Bonehevan, Baratoux, Massei, Baurowicz, Lennox-Brown, Hobert and Cornil and Babes have affirmed the Loewenberg discovery.

According to Cornil and Babes, Loewenberg's ozenacoccus is found as large cells, sometimes joined together, 0.5 to 1.0 mikron in diameter. It may be cultivated on gelatin, giving the characteristic odor of ozena. Is is pathogenic for mice—death ensuing in from 1 to 2 days. It has been proved further that Loewenberg's ozenacoccus is identical with Friedländer's pneumococcus (Klamann, Thost, de Simoni, Strazza, etc.).

Paulsen found Friedländer's pneumobacillus in 15 cases of ozena; Abel found it in 16 cases in 1893 and 1895. They claim that in addition to Friedländer's bacillus, another is constantly present, which they call the bacillus mucosus and which is specific for ozena and atrophic rhinitis. Abel's bacillus is 1.25 mikra wide and of varying length; it is stained with methyl blue, carbol fuchsin, anilin fuchsin and anilin methyl-violet, also with Gram. It may be cultivated very well on agar-agar and it is pathogenic for white mice (death from typical septicemia).

Hajek, Dreyfus and Klemperer acknowledge the existence of Loewenberg's ozenacoccus, afterwards proved to be Abel

and Paulsen's bacillus mucosus ("Kapselbacillus"). They regard the ozenacoccus and the bacillus mucosus as identical with Friedländer's pneumococcus. The microorganisms, however, are in the secretions but not in the tissues of ozena patients.

Marsano (1890) and Kyle (1894) proved that the bacilidis atrophicae is the most commonly found. In 1900, the Italian writers Bellfanti and della Vedova stated that two forms were found in the crusts: 1. Loewenberg's and Abel's bacillus mucosus; 2. Bacillus pseudodiphtheriticus, which they regard as specific for ozena.   ,   ,

Pes and Gradenigo confirmed this discovery; they found still another kind of bacillus. Auche and Brindel found in 20 cases of atrophic rhinitis, Loewenberg's bacillus mucosus in 20, bacillus diphtheriticus 18, staphylococci 12 and streptococcus 4. De Simoni found the bacillus mucosus of Loewenberg-Abel constantly present; he also found Fraenkel's bacillus foetidus which Baurowicz calls bacillus capseolatus rhinitpneumobacillus of Friedländer and the bacillus typhisimilus were not constantly found present.

Perez in 1900 claimed that the cocco-bacillus foetidus ozaenae was the specific bacterium. Symes found a bacillus very similar to the diphtheria bacillus in 87 per cent of 23 cases examined, so that he regards ozena as a chronic form of nasal diphtheria.

According to Klemperer and Scheier (1901), the ozena bacillus is identical with Friedländer's pneumobacillus as well as with Frish's bacillus rhinoscleromatis. They succeeded in immunizing against the rhinoscleroma bacillus and vice versa. Baurowicz does not agree with this opinion.

Delie and M. Schmidt found the aspergillus fumigatus and penicillium glaucum present in cases of ozena, naturally as parasites.

Although the parastic origin of simple and fetid atrophic rhinitis is the most plausible (Krieg, Cozzolino, Baurowicz, Wright and I hold this view), there are many opponents (Otins, Lombard, Rethi, Longhini, Burger, Siebenmann, Cholewa, Cordes, Hecht and Grosskopf).

LXIV.

LARYNGEAL DISTURBANCES PRODUCED BY VOICE USE.*

(Vascular, cellular, neuromuscular angioma; papilloma; "singer's nodes" in speakers and shouting children; voice fatigue; vocal strain; dysphonia spastica. Principles of prevention.)

By W. E. Casselberry, M. D.,

PROFESSOR OF LARYNGOLOGY AND RHINOLOGY IN NORTH-WESTERN UNIVERSITY MEDICAL SCHOOL.

CHICAGO.

That which is merely "use of the voice" for one person may be overuse for another; hence, both are pertinent to the present discussion. To the singer with failing voice, to the orator with lack of carrying quality, the teacher with recurrent aphonia, the clergyman with spastic vocal contortions and to a host of business folk—dictating correspondents, salesmen, callers and others, the gathering of knoweldge tending to the preservation of the voice is of weighty importance.

The laryngeal disturbances produced by voice use may be grouped under three divisions: vascular, cellular and neuromuscular. Strenuous vocalization excites vascular congestion even in a vigorous larynx, as may be observed in singers after the rendition of difficult roles and in clergymen on the Monday morning following an arduous Sunday. When the larynx is previously weakened by disease, hyperemia is induced by correspondingly less vocal effort, ordinary conversation then sufficing to maintain congestion of the larynx and consequent relaxation of the vocal muscles, as exemplified by a recent case (1) of an incessant talker who, while suffering from

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acute laryngitis, ran the gamut of sprays and pigments, but permitted no rest to the larynx. Finally, discouraged, and contemplating a change of climate, at great business sacrifice, he consented to a strict adherence to pencil and writing pad, which rest to the vocal organ sufficed to restore his voice in so short a time that it was jocularly referred to as a miracle.

This incident is mentioned to emphasize the well-known but much neglected principle of the need of comparative or even complete vocal rest to an acutely inflamed larynx as a means of treatment. The same principle is of value as a prophylactic measure, the neglect of which was illustrated in the case (II) of an exceptionally forceful concert singer who had been in excellent voice prior to an attack of acute laryngitis during which she persisted in meeting her singing engagements. A few weeks afterwards an angioma of one vocal
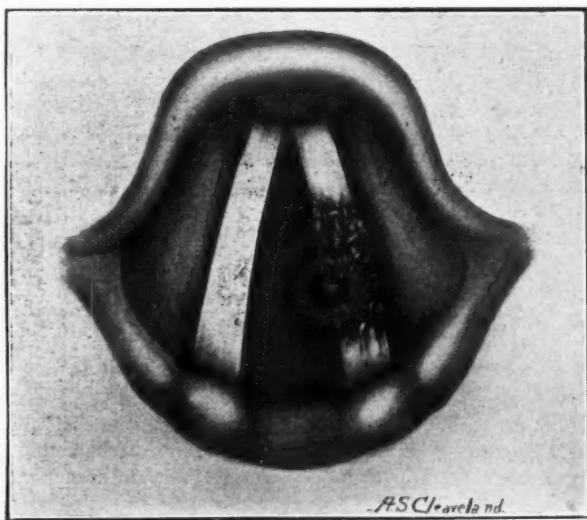
Fig. 1.

cord was seen to have developed (Fig. 1). In confirmation of its cause as assigned, I quote from Wyatt Wingrave,[1] "that such angiomata show an increasing vascularity from

a simple hyperemia up to permanent distension and thrombosis." Later in the case, it was found necessary to remove the angioma by galvano-cauterization before the patient's voice could be restored.

Moreover, if there be disease of the accessory vocal organs, e. g., the pharynx, the larynx functionates at a distinct disadvantage° and then vascular congestion, muscular atony and even cellular hyperplasia of the vocal cords are liable to result from what may be little more than a customary use of the voice.

CASES III and IV.—A vaudeville singer was handicapped by an unreliable voice; he had laryngeal congestion with atony of the cords accompanied by redness and thickening of the faucial pillars due to retention tonsillitis 'in the deeply placed bases of imperfectly operated tonsils. A tonsillectomy remedied the whole difficulty, his voice becoming thoroughly competent. On the other hand (Case IV), a country clergyman who continues to endure a chronic retention tonsillitis, while attempting to preach thrice on Sundays and to furnish the music as well, suffers from voice fatigue and many periods of vocal disability.

These experiences being typical, justify formulating a second principle of prevention which is well known to laryngologists, but which is not yet generally recognized, although it is of great economic value to vocalists, viz.: To conserve the voice under maximum use, diseases of the pharynx or nose should be promptly remedied.

Although masters disagree as to what constitutes right or wrong methods of singing, it surely is wrong, in technical phrase, to force the voice, whether in singing or speaking; that is, to compel higher notes than are natural to a given register, to maintain an abnormally loud intensity by reinforcing the blast, to habitually pitch the voice into the falsetto register, or to time overwork the muscular mechanism. To attempt even one's customary role of song or speech at a time of disability either of the larynx or accessory vocal organs is equally a forcing of the voice.

The fact that "singer's nodes" occur also in speakers and others who, by habit or necessity, force the voice in some of these particulars, indicates that the method of singing known as "striking the glottis," although possibly the main cause with singers, as explained by Holbrook Curtis, is not the only wrong

or forcing method which is capable of exciting these minute cellular hyperplasiae at points of attrition. All artificiality of method certainly can be excluded by reason of youthfulness, in the following instance of typical "singer's nodes" observed in a boy who did not sing:

CASE V.—A boisterous lad of 9 years, described by his parents as an incessant talker and shouter, whose voice always dominates the field of boyish sports, has suffered increasing hoarseness for a year. A small adenoid has been operated simply for exclusion. The laryngeal image plainly discloses a pair of vocal nodules on the edge of the vocal cords at the junction of their anterior and middle third (Fig. 2).
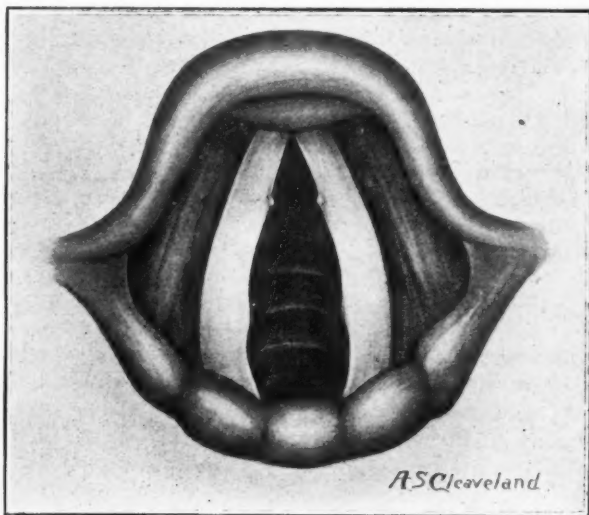
Fig. 2.

The formation of nodes during that sort of forcing of the voice which is impelled by ordinary use of it through periods of disease of the larynx or accessory vocal organs, is exemplified by,

CASES VI and VII.—The former, a choir singer with chronic

retention tonsillitis which she disregarded notwithstanding frequent inconvenience until a pair of nodes causing roughness of the voce compelled attention. The outcome was unusually fortunate, as the comparative ease of vocal execution which followed a fragmental tonsillotomy enabled her to continue "in voice" in spite of the nodes, which when last seen had grown smaller as if gradually to disappear. In the latter case (VII) a kindergarten teacher with unsuspected incipient tuberculosis presented an anemic larynx, paretic vocal cords with a pair of nodes, but no other inequalities. Rest to the voice being advised she left the city for six months, and on her return tuberculous pyriform swelling of the arytenoids was present, but the nodes were gone. The inference is that they had formed under the stress of her kindergarten vocal teaching which, for a larynx partly disabled by incipient tuberculosis, amounted to a forcing of the voice.

My observation of papilloma of the larynx in adults serves merely to support the general experience, that voice users are especially subject to it. The inference is the more reasonable since, as stated by Wyatt Wingrave,[2] "hyperemia if sufficiently prolonged or repeated, may result in the histologic dystrophic changes" which constitute a papilloma.

Of course, there are other etiologic factors, but excessive vocalization and consequent hyperemia were the only evident causes in:

CASES IX and X.—Middle-aged gentlemen, one a board of trade operator accustomed to extreme vocal effort on the "floor," and the other a political campaign speaker much in demand at open air meetings on account of his sonorous bass. Each was obliged to relinquish his vocation on account of increasing, persistent hoarseness due to a characteristic papillated neoplasm of the anterior half of the vocal cord, removal of which by intralaryngeal methods eventuated in perfect recovery without recurrence during known periods of ten to fifteen years, although neither thereafter exacted as much use of his voice.

In designating my third division of disturbances of the larynx due to voice use, as neuromuscular, I am conscious of entering upon a phase of the subject of which, even after all is said, our conception of the disorder is still but vague.

Lesions cannot be said to be strictly muscular unless implication of the peripheral nerve endings can be excluded.

However, the rupture of fibres of the internal tensor muscles during their use is certainly a purely myopathic lesion. This sort of functional traumatism is said to happen sometimes to singers, but my own observation of it is limited to the case of a broker.

CASE XI.—Mr. A. R., while vociferating during a panic "on change," felt suddenly a twinge of pain and found himself voiceless. On examination a few hours later the right vocal cord appeared as if it had been struck by a hammer—ecchymotic, swollen, relaxed. The left cord was normal.

Muscular strain from forcing of the voice which affects chiefly the internal tensor muscles—the thyroarytenoidei interni and perhaps the arytenoideus, may be viewed simply as a milder degree of functional traumatism and therefore chiefly a myopathic lesion. In inflammatory paresis, the terminal nerves are thought to participate, therefore it is typically neuromuscular, while in the following notable instances of unilateral double tensor paresis and of dysphonia spastica, the neuropathic element seemed to predominate.

CASE XII.—Rev. J. G. spoke, in part, in the low measured tones of the cultured, but his voice on approaching the several climaxes of a sermon, would suddenly break into the falsetto register like the high pitched enunciation of certain persons in anger but intensified by an enforced blast. It sounded as if it were very wearing to his larynx, and toward the close the exhausted mechanism would weaken, hoarse up and emit jerky and scarcely audible tones, defects which with time, so augmented as to threaten his professional career and to strongly suggest an impending dysphonia spastica. On examination there was noted, pronounced paresis of the left vocal cord, its excursion on phonation falling far short of the middle line. On close analysis it proved to be a conjoined paresis of the external tensor muscle (cricothyroideus) and the internal tensor (thyroarytenoideus internus). The paretic cord and the arytenoid seemed to occupy a lower vertical level in the larynx than the sound one, so that their edges did not meet in the same horizontal plane, which is stated by Gottstein to be a sign of double tensor paralysis. The right arytenoid would override the left, but the picture was not identical with recurrent nerve paralysis, and the usual causes of the lattere were excluded by subsequent observation through a period of ten years. After a few weeks' rest he was able to resume preach-

ing by complying with my advice to restrict the delivery to his more pleasant conversational style. The cord recovered in large measure after some months, but relapsed the following year as he lapsed into the old emotional falsetto style; it again recovered, but three years later again relapsed. During the past six years his more quiet delivery has become habitual, the vocal cord remaining fairly well and just now quite normal in appearance.

Some of the details of the following case of dysphonia spastica I abstract in part from the published report by Dr. John Edwin Rhodes[3], as the patient was observed by myself only informally as a friend, although closely observed and over a long period of time. It is introduced to afford opportunity of comparison with the preceding case and for the purpose of further comment, although I will take occasion to add the termination and to amplify certain phases of it.

CASE XIII.—Mr. C. L. was a noted clergyman who first came under my notice in 1883, when in his 54th year, at which time his voice was beginning to show the earliest definite indications of this phenomenal disease. In opening conversation, he would first strike an attitude by posing his head backward and aside, as if in an effort to facilitate an impeded utterance. The words when they came seemed to be popped out under high pressure and had a disagreeably tense klang, the fewest possible being made to suffice. In preaching he did better, but the pitch was erratic with much falsetto and syllables were sometimes suppressed. Three years later he sought advice, and on examination Dr. Rhodes observed paresis of the right vocal cord and again observed it five months later; but at subsequent examinations, this feature was not noted, probably having been incidentally due to the forcing of the voice in the face of its disability. In this connection I would recall the paresis of one vocal cord, in conjunction with the falsetto habit in the preceding case (XII). In 1893, ten years from the time of my first observation, he was obliged to retire from the pulpit, having become nearly inarticulate in spite of long periods of rest and varied treatments. In attempted utterance, spasmodic contortions of the facial muscles, visible contraction of the neck and chest and congestion of the face would precede by some seconds the jerking out of a few words which came finally, perhaps, in a loud oratorical tone or in a hoarse whisper, or fal-

setto key, the pitch being quite uncontrollable. About this time, quite a sensation was caused by the announcement that a new treatment had effected a cure and that he would preach the following Sunday, when to my astonishment he did speak distinctly better, albeit far from well. It was subsequently disclosed that the new treatment consisted merely of spraying a cocain solution into the nostrils, that its beneficent effect would endure but an hour and was followed by "terrible reactionary suffering," so that he limited its use to occasions of special church celebrations. During the next ten years he grew worse, notwithstanding an almost continuous silence. Attacks of asthmatic dyspnea conjoined with heart weakness, both said to be of nervous functional, rather than of organic, nature, helped toward a final exhaustion.

What was the exact "laryngeal disturbance" in this case, in what manner was it "produced by voice use" and how did cocain serve to temporarily suspend the disability?

Rhodes,[4] following Mackenzie,[5] ascribed the laryngeal impediment to spasmodic contraction of the tensor muscles of the larynx, which he was able to observe in another similar case, but not in this one, in whom, at the worst stage, the muscular movements as seen in the laryngoscope appeared normal. Semon[6] refers to several cases which presented symptoms identical with the foregoing, in all the worst of which he observed laryngoscopically a spasmodic sphincter-like closure of the larynx on attempts at phonation, indicating in addition a spasm of the adductors. In other words, the larynx under cortical superexcitation overdoes its effort at tone formation, contracts too quickly, too violently; that is, incoordinately with the other elements of speech, ideation, volition, respiration, articulation, hence it fails to emit the tone at the proper psychologic moment—a sort of laryngeal stammer. Like common stammer, it is aggravated by the intuitive accessory muscular efforts of the patient to make himself talk as evidenced by facial and chest contractions, but unlike common stammer, the habit is induced later in life, during the course of years and is acquired chiefly by professional voice users, notably clergymen, through unnatural and enforced methods of address in which the high pitched falsetto register is a factor. The emotional temperament which is a natural characteristic of clergymen, is a predisposing condition in so far as it is prone to find expression in the falsetto key

and otherwise to render speech unstable, and if to emotionalism is added, that dyscrasia, which results in asthma, hay fever, nervous dyspepsia and nasal reflexes, the predisposition to dysphonia spastica may be said to be accentuated. Phonetic adduction of the vocal cords is for the purpose of speech in expression of thought, hence the major adduction centres are located in the cerebral cortex, and it is conceivable that under years of emotional impulses leading to high pressure speech, that these centres should acquire a vicious habit of spasmodic violence in action.

The third principle of prevention which I seek thus to establish is, that voice users, especially preachers, should avoid falling into the custom of using high tension speech or the falsetto register, for the reason that it not only does local violence to the neuromuscular mechanism of the larynx, but being an expression of emotionalism, it is liable to habituate the cortical motor centres to an undue excitability, leading to dysphonia spastica

It remains to suggest an explanation of the action of cocain, whose salient effect is local anesthesia, in ameliorating a spasmodic dysphonia which was primarily of centric origin. Two premises may be restated: First, that the fundamental laryngeal spasm was aggravated by accessory spasms, some intuitive, some doubtless reflex, inasmuch as coordinated articulate speech is dependent in part upon a local feeling which guides the play of the delicate muscles through a reflected stimulus. Second, that the cocain only partly, not wholly, ameliorated the dysphonia. It is a fair deduction that by overflow of the nasal cocain spray into the throat, this reflex stimulus was dulled, and to this extent only was the disability ameliorated.

REFERENCES.

1.   Wyatt Wingrave.—The Journal of Laryn., Rhin. and Otol., March, 1906, page 161.

2.   The Journal of Laryn., Rhinol. and Otol., May, 1906, page 218.

3.   Rhodes.—Spasm of the Tensors of the Vocal Cords. By John Edwin Rhodes, M. D., Trans. Am. Laryn. Assoc., 1898, page 197.

4.   John Edwin Rhodes.—Loc. Cit.

5.   Morell Mackenzie.—Diseases of the Throat and Nose, Vol. 1, page 474.

6.   Felix Semon.—Heymann's Handbuch, Band 1, S. 753.

LXV.

THE REMOVAL OF ADENOID VEGETATIONS THROUGH THE NASAL PASSAGES BY A NEW METHOD.*

By Otto T. Freer, M. D.,

ASSISTANT PROFESSOR OF DISEASES OF THE THROAT, NOSE AND
CHEST, RUSH MEDICAL COLLEGE; PROFESSOR OF
LARYNGOLOGY, CHICAGO POLICLINIC,

CHICAGO.

The adenoid curette or ringknife in its many forms is at the present time so widely used for the removal of adenoid vegetation that its employment is understood as a matter of course by most authors when the operation is alluded to. Its popularity is not a proof of the perfect fitness of this implement for its purpose, however, for the wish to complete all surgical procedures with the least expenditure of time and effort is apt to make those methods and instruments the favorites that hasten the performance of an operation and make it as nearly mechanical as possible. For this reason devices with as nearly automatic action, which replace as much as they can the performance of instruments representing extensions of the intelligently acting fingers and hand, have always proved alluring, because they are designed to accomplish with one sweep what would otherwise take time and trouble.

The fault of these mechanical inventions, however, is their lack of adaptability to the varying conditions both anatomic and pathologic apt to be encountered, for while they fit more or less well a certain form of an affection which their designer had in mind when he fashioned them, they apply themselves poorly or not at all to variations differing even moderately from it in structure or surroundings. An example of this kind of device is the popular tonsillotome, which with approximate exactness removes the small class of superfici-

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ally projecting tonsils which represented typical tonsillar hypertrophy and its anatomic relations to its inventors, but which is an instrument not at all adapted to the much larger genus of partly or wholly submerged enlargements of the tonsils, buried between the pillars of the fauces. The form and mode of action of the ringknife is evidence that its designers had in mind the tonsillotome in constructing it, and with the tonsillotome it shares the fault of a mechanically acting instrument fitted for but one type of a condition presenting widely differing varieties.

The same conception that led to the creation of the tonsillotome, that the tonsil to be removed was always well defined and prominent, seems to have guided the designers of the ringknife, who evidently had a preconceived idea that the type of enlarged pharyngeal tonsil usually encountered forms a circumscribed mass projecting like a faucial tonsil from the vault of the pharynx. An adenoid growth of this kind is, of course, well designed to be planed off with the ringknife, but in my experience this variety is much rarer than proliferations of lymphoid tissue of more extensive and diffuse origin which not only hang from the pharyngeal vault but occupy the posterior wall of the pharynx, both the recessus pharyngei and often the posterior portions of the nasal fossae, in front of the choanal openings. The ringknife could only cut away the central portion of such a collection of adenoid vegetation, while unable to reach the growths on the posterior wall, in the recessus and choanae.

Chiari (*Krankheiten der Oberen Luftwege,* Vol. II, page 119, 1903) states that vegetations low down on the posterior wall of the nasopharynx often and those in the recessus pharyngeus always escape the ringknife, and Johann Fein (*Wiener med. Wochenschrift,* No. 45, page 2152, 1905), himself an advocate of the principle of the ringknife, says that it cannot reach any adenoid growths in the fossa of Rosenmueller (recessus pharyngeus) or those attached to the upper boundary of the choanae in the domain of the nasal cavity. But even where the adenoid vegetations do not grow in the posterior nares, and their attachment begins just behind the septum, the ringknife may fail to reach them because the advancing blunt edge of the blade pushes the foremost fringe of the growths forward into the posterior nasal openings.

Max Goerke (*Fraenkel's Archives für Laryngologie,* 1902, page 278) says: "In using the curette, a portion of the soft adenoid tissue that is wedged in between the instrument and the border of the choanae is pressed into them and gradually expands again afterwards." In addition, the pendulous masses of lymphoid tissues so frequently found hanging from the pharyngeal vault and which slip aside so readily, may avoid the ringknife or be incompletely divided by it so that they remain attached to a pedicle in the nasopharynx. This condition is described by Chiari (*loc. cit.*).

The ringknife possesses another fault which makes it possible for portions of an adenoid growth to escape removal by it. Its blade does not cut in the manner of a knife by slicing, as it is drawn through the tissues, but its edge impinges squarely against the material to be removed, with no sliding motion, so that there is a tendency to scrape over the adenoid masses rather than to cut them off, especially when they are freely movable and the vault of the pharynx is concave laterally so that the edge of the knife does not fit flatly against it.

Fein (*loc. cit.*) describes still another condition that makes a complete removal of the adenoid vegetations with the ringknife uncertain, and that is the limitations of the motions of the handle by the incisor teeth of the lower jaw below and the incisor teeth of the upper jaw, and the hard and soft palate above. The impinging of the handle on the lower incisors limits the motion of the blade forward, so that in cases where the jaws cannot be opened very widely, it fails to reach the anterior part of the adenoid growth, and, as Fein states, the incisor teeth of children have been broken out in the violent attempt to include the foremost vegetations in the sweep of the knife. A long hard palate, aided by a rigid soft palate, also limit the forward reach of the blade, while its backward sweep is interfered with by the incisors of the upper jaw. Curving the stem to permit a good forward reach of the blade interferes with its backward excursion by reason of contact with the upper incisors, so that the straight stem is the best. Fein thinks that he has overcome these obstacles by the bayonet-shaped handle of his curette which carries the shank out of one corner of the mouth. Chiari, however, does not find that he can always operate radically with Fein's instrument, and the bayonet

handle adds another bend to an instrument whose motions are already complicated by too many.

A certain type of adenoid growth often encountered by me is also unfavorable for the ringknife. I refer to the tough, firm, fibrous enlargement of the pharyngeal tonsil found in some children and often in adolescents and young adults. The blade is apt to slide over such masses without cutting away more than a small portion of them.

These reasons suffice to show that the ringknife is uncertain in its action, as is admitted by its advocates. It may completely remove the enlarged pharyngeal tonsil in suitable cases. In others it will cut away enough to produce improvement, so that the child breathes better than before the operation, but still has to be urged to close his mouth, and this persistence of mouth-breathing is then spoken of as a "habit." In a number of cases, however, the action of the knife is so superficial that the adenoid growth promptly reforms after its use, and the child is as badly off as before.

The tendency to a more or less complete reproduction of adenoid tissue from its vestiges after operation is described by Max Goerke, who refers to the extraordinary power of regeneration possessed by lymphatic tissue, and says that the remains of adenoid growths may increase in size by exuberant granulation from the cut surfaces until the dimensions of the original vegetations are reached, and that even after a thorough operation by the ringknife, exposing in places the basilar fibrocartilage, portions of lymphatic tissue remain imbedded in the median line which escape the knife and become the source of regeneration of the adenoid vegetations.

The median portion of the growth is especially apt to be thus superficially removed where the pharyngeal vault is concave in the centre as it often is, the ringknife not being able to enter such or other depressions, as its shape fits it only for a level planing off of the hyperplastic tissue. Post-nasal inspection in cases of this kind shows a deeply hollowed centre in the pharyngeal tonsil in the region called the recessus pharyngeus medius by Disse (*Heymann's Handbuch der Laryngologie,* Vol. II, page 24), which would be but superficially if at all reached by the blade of the ringknife. It has been my experience, and that of others, to meet a good many patients whose adenoid vegetations have been completely reproduced after a curettement with this instrument. Fein says

that even men of skill, who have performed the operation
thousands of times with it, from time to time fail to obtain
a result.   One failure, however, neutralizes the benefit to
the operator's reputation of a number of successful operations,
and the numerous relapses following the use of the ringknife
have brought adenoid operations in general somewhat into
discredit with the public.

In order to be sure of freedom from these annoying re-
turns of adenoid vegetations, it is necessary to extirpate them
radically, and any method that will accomplish this, even if
it be more tedious than that of the ringknife, is to be pre-
ferred   to   it.   As   rivals   to   the   ringknife,   post-nasal
forceps have always held their own, though overshadowed
by it, and they are certainly capable of a deeper and more
thorough removal of the growths, as they are able to follow
the adenoid tissue into hollow places and thus to clear it out
of the highest portion of a funnel-shaped pharyngeal vault
which would escape the level planing of the ringknife.   The
post-nasal forceps shares, however, with the latter the dif-
ficulty of operating with an instrument with confusing curves
that make complicated muscular movements necessary.   While
with the ringknife the sense of direction of the surgeon is
the only guide for the instrument operating hidden in the
nasopharynx, and for this reason it has occasionally wounded
the tubal prominences, the motions of the post-nasal forceps
are to a certain extent under the control of the index finger
inserted behind the soft palate, the sense of touch indicat-
ing to the beak of the instrument the location of the separate
growths.   Unfortunately, there is but little room in the naso-
pharynx for both finger and forceps, and for this reason I
have usually found it necessary to withdraw my finger partly
before seizing the desired growth, so that a certain amount
of uncertain groping for the vegetations also belongs to the
post-nasal forceps.

On account of this lack of the exact knowledge of the
whereabouts of the jaws of the instrument, I have seen an
operator break off a large fragment of the vomer with it,
and I have known surgeons to introduce it many times be-
fore it could be made to seize a certain adenoid growth.   The
post-nasal forceps has the advantage over the ringknife that
it can clear the fossa of Rosenmueller and also the posterior
wall of the nasopharynx fairly well, but, as stated, its curves

make it an awkward and somewhat uncertain tool, and by reason of its size and the lack of exact control of its motions, it is not a suitable instrument for clearing the posterior ends of the nasal fossae which, just beyond the choanae, are in my experience often filled with pendulous adenoid tissue.

As rivals to the forceps or ringknife, the sharp spoons cannot come into question, movable masses avoid them, they cannot remove tough fibrous growths, and, as Chiari states, they are apt in places to penetrate the tissues to a dangerous depth.

Besides the oral mode of access to the growths with its complicated curves, there is the direct route through the nasal passages, first adopted by W. Meyer, but abandoned since by all operators for the roomier way through the mouth, as apparently instruments of sufficient size to remove the adenoid growths rapidly cannot be passed through the nares. That this is only apparently the case, I hope to be able to make clear in this paper.
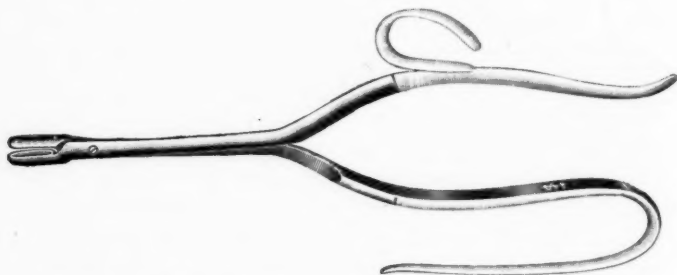
Fig. 1.   The pernasal forceps for the removal of adenoid vegetations.   The handle of the instrument is so arranged that it can be opened and closed like shears.

The advantage of the nasal route is its directness, so that a straight instrument without curves or angles to confuse the muscular sense can be passed through it, and can therefore be easily guided with exactness.   Another factor in favor of this mode of access to the nasopharynx, is the ability to keep the index finger in the nasopharynx to control every step of the operation by the sense of touch and to push the adenoid vegetations toward the operating instrument.   The one I employ is a forceps with smoothly rounded beak (Fig. 1),   It

is a modification of an instrument which in its unchanged form proved singularly suited to the operation in a number of my first cases, Ingal's nasal bone forceps. I have adapted this to the adenoid operation by changes in its construction and an arrangement of its handle so that it opens and shuts like shears.

The jaws of the instrument should have a soft spring temper, as, if hardened too much, they are apt to break off. The uncertainty as to whether I had removed all of the adenoid vegetations in using the post-nasal forceps, first induced me to finish the operation by cutting away such adenoid growths as were left behind by means of the per-nasal forceps described passed through the nose, and as I grew more skilful with it I began to use it for the whole operation and have done so for the past few years.

At first the instrument seems too large to pass through a child's nares without force, but in practice I have never had material difficulty in introducing it through the nostrils of even very young children, the youngest one operated on this way being but 6 months old. The reasons for the ready introduction of such a comparatively large instrument through the nasal fossae of a child are the proportionately large heads of children, giving them relatively roomy nostrils; their broad faces which are accompanied by correspondingly broad nares; the undeveloped state of their turbinated bodies and the elasticity of their growing nasal septa. The latter factor makes it possible to even insinuate the forceps past moderate cartilaginous or slight bony deflections of the septum. The little turbinated bodies of the child with their small amount of bony tissues are readily compressed against the outer wall of the nares.

The mode of operation is as follows: General anesthesia combined with local cocain anesthesia is employed, the child being barely in half narcosis, while a good deal of reliance is placed on the local insensibility obtained by means of a small amount of a 10 per cent spray of cocain introduced into the nostrils when the child begins to go to sleep. When the narcosis is sufficient a gag is inserted, the child is placed on its left side with its left arm behind it, the head is thrown well back, the face is brought clear to the edge of the table and is slightly inclined downward so that the blood can run out of the mouth and nose, the position being one employed for

many years by Ingals and others for all adenoid operations and recently exploited as a new method. The finger is then introduced into the nasopharynx, while the forceps, with its side looking towards the roof of the child's nose, is introduced through one of the nares, following the septum and nasal floor, very slight force being needed to make it pass through the posterior naris to reach the index finger in the

Fig. Lateral view of a sagittal section of the head showing the finger in the nasopharynx guiding adenoid vegetations into the jaws of the pernasal forceps introduced through the nose.

pharynx (Fig. 2). The forceps is then turned so that its broad side looks towards the vault of the pharynx and the jaws are widely opened while the index finger guides as

much of the adenoid growth into them as they can hold; they are then firmly thrust into the base of the mass and, with their cutting edges, partly tear and partly cut it off. The forceps is then turned so that its side looks towards the roof of the nose and is withdrawn, the removed piece of tissue being dropped into a glass of boric acid solution.

The procedure is repeated through the same and the other nostril, until no more adenoid growths can be felt with the finger, and the beak of the forceps encounters firm, fibrous tissue over the entire site of the growth. The vegetations in the fossa of Rosenmueller (recessus pharyngeus), those on the posterior pharyngeal wall, those in the highest part of the pharyngeal vault, and the adenoid growths in the posterior nares are all readily reached and torn away. By crowding the beak of the instrument into the growths their removal to the bottom of the lymphoid tissue is assured, and there is no difficulty in entering hollow places in searching for it. The index finger is withdrawn from time to time to give the child a spell of unobstructed breathing. The operation is not lengthy and may be performed in a few minutes, the forceps often taking the greater part of the mass of the pharyngeal tonsil in one bite. The accuracy with which pendulous growths may be guided into the jaws of the instrument is most pleasing, as well as the exactness with which every vestige of adenoid tissue may be removed from the places inaccessible to the ringknife mentioned. The precision with which the forceps does its work is due in part to the constant control of its presence by the palpating ball of the index finger, the finger and the forceps, as it emerges from and recedes towards the nose, constantly meeting in concerted action. An attempt to feel similarly the postnasal forceps while it is seizing the growths is always imperfect, as the presence of the instrument and finger in the nasopharynx at the same time is a hindrance to both, especially in small throats, and where control by palpation is attempted at all it has usually to be done with the nail and not the ball of the index finger.

One of the chief advantages of the per-nasal forceps over the post-nasal one and over all other instruments operating by way of the mouth is that it pushes the adenoid growths out of the posterior nares, making them accessible and at-

tacking their foremost part where the obstruction to nasal respiration is greatest, while the tendency of the post-nasal instruments is to crowd the vegetations forward into the choanae beyond their reach. This became strikingly evident to me in the cases where I finished operations begun with the post-nasal forceps by means of the per-nasal one, which pushed out of the posterior nares and removed astonishingly large remains of adenoid tissue after I had deemed all of it taken away with the post-nasal forceps.

The tubal prominences in the operation through the nose are not in danger, as they may readily be felt and protected by the index finger. As in all things, experience is required to acquire the technic of the operation I have described and to learn to perform it rapidly, but I have had no difficulty in teaching the method to my assistants and pupils. I have never known of the return of the adenoid vegetations after this mode of operation, and the children all cease their mouth-breathing after a few days to a week. Though I do not deny that a true mouth-breathing habit may exist in some cases in children possessing a free way for nasal respiration, and that in others deformities of the jaws misplacing the teeth may prevent closure of the lips without effort, as a rule a child that continues to use his mouth for breathing after an operation for adenoid vegetations has not been completely relieved of them.

Excepting in one case, I have never seen injury to the nose from the operation, at the most a moderate reactionary swelling of the mucosa partially occludes the nares for a few days, and this slight nasal irritation is a small price to pay for the assurance that the removal of the adenoid growths has been radical. In the one case referred to, a small adhesion formed between a lower turbinated body and the septum as a result of abrasion of the mucosa by a roughened projecting screwhead at the lock of the forceps. To avoid a repetition of this accident, I have sunk the screwhead and also have had the sharp corners of the jaws below the lock rounded off. I have never had unusual hemorrhage during the operation and have had no post-operative bleeding. In adults and older children, it may be performed without general narcosis with merely cocain anesthesia, pure cocain flakes being conveyed by a minute moist swab through the nose and post-nasally into the nasopharynx and applied along the route of

the forceps.   Done in this way, the operation is not especially painful, but nevertheless requires courageous patients.

No after-treatment is required.   Enlarged tonsils may be removed as a preliminary.

The procedure I have described differs so radically from the traditions that I expect it to meet with little favor; at least, at first.   In its defense, I can say that of those who have seen me operate by this method, all seem convinced of its merits and my pupils are its enthusiastic advocates.   The instrumentarium is exceedingly simple and inexpensive, and I hope that a few will make use of it at least to supplement the instruments they are accustomed to, where growths unreachable by the ringknife need removal from the fossa of Rosenmueller, the choanae and the posterior pharyngeal wall.   I also suggest its employment where a relapse after a curettement indicates the use of another method.

LXVI.

PRESIDENT'S ADDRESS BEFORE THE AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCIETY, KANSAS CITY, 1906.

BY J. E. LOGAN, M. D.

KANSAS CITY.

It has always been the custom of this Association to hold its annual meeting in the home town of its presiding officer; but never before in its history has it been called upon to cross the eastern bank of the Mississippi River, and venture so far to the westward. The honor you have done me, gentlemen, is so much beyond my deserts that I will not even attempt to express my appreciation of it, but shall merely add to the words of welcome you have already heard, my personal heartfelt thanks for your kindness and courtesy, and my sincere hope that nothing will occur during your stay with us that will cause you to regret the unusual effort you have put forth in coming.

The holding of the twelfth yearly session of the American Laryngological, Rhinological and Otological Society in Kansas City not only marks an epoch in the growth of this young metropolis—of which we its citizens are so fond and possibly a trifle too proud—but it registers a long step forward in the development of our particular corner of the great field of medical science.

Scattered all over this wide Middle West, are scores of men, co-workers with us, bright, energetic young fellows, well equipped in the main and alive to their duties and their responsibilities who, nevertheless, are so deeply engrossed in the daily routine, so busy with the hard grind of general or special practice, that they cannot—or they think that they cannot—break away each year long enough to attend a medical convention in a distant city. They can come to us here, however, and to such men the presence of so large a body of distinguished specialists, of so many successful students of those same knotty problems with which they themselves are constantly wrestling, cannot fail to be a present inspiration and a permanent benefit.

The germ of enthusiasm is communicated most swiftly and unfailingly by personal contact. It is one thing to read in a professional journal a long technical article reporting the results of a series of tedious experiments, or to glance hastily through a pithy paragraph heralding a discovery, that may or may not be revolutionary in its consequences; it is another and a very different thing to listen to the voice of that same patient investigator as he rehearses, step by step, his cautious, but no longer tedious processes; or to catch fire from the spark that lights the eye of that one who has captured another of Nature's guarded secrets, or who has come out victorious in battle with another of humanity's dreaded foes.

So potent a factor do I regard this face-to-face encounter between soldiers fighting under the same banner, that I shall be as much surprised as disappointed, if many new names are not added to our roll-call as the direct result of this convention. Should that be the case, virtue, which is always a sufficient recompense, will not be its sole reward. These fresh, unworn recruits will not come to us empty-handed. They will give as well as receive. The infusion of new blood into our veins will necessarily show itself sooner or later in the greater vigor and activity of our whole body. We have heretofore largely increased our usefulness in this way, and perhaps no greater good has resulted—indirectly—from this organization that this opening up of new spheres of influence by means of our annual change of meeting place.

In reviewing the work of this Society during the few years of its existence, I find so many reasons for satisfaction—with ourselves—that I should not dare recite them all even right here in the family. I shall presently mention very briefly one or two things that seem especially to invite self-felicitation, but before doing so I must ask your consideration of some matters of practical business.

In pursuance of our policy of encouraging first-hand investigation within our membership, we have, as you know, recently set apart the sum of five hundred ($500) dollars, and have authorized the judicial committee to select from the material annually submitted to it, the article, monograph or volume which in its judgment shows most original research, and reimburse the author for the actual cost incurred in getting out his work.

This is a move in the right direction, but in my opinion the fund is insufficient for the purpose, and should as soon as prac-

ticable be substantially increased. With more money at their disposal, the judges could exercise some discretion as to the amount of reimbursement required in each case; and, besides putting a more liberal interpretation upon the rigid letter of their instructions, they could enlarge considerably the scope of the competition.

It goes without saying, that I am not proposing to pay the successful competitor for the time and labor expended. I should as soon think of suggesting that he be paid for the clear brain and the unselfish purpose that made that time and toil fruitful. That would be neither possible, nor in this case desirable. The pure joy of achievement, the calm pleasure that comes with the consciousness of a worthy task nobly done is—if not reward enough for any man—certainly reward enough for any member of that profession whose proudest distinction is that it puts the welfare of all so high above individual profit. But while I am far from wishing to dangle a money prize before the eyes of our ambitious and gifted brethren, I do not forget that on this particular planet at this particular stage of its social evolution, money is a very necessary evil, and doctors are not invariably multi-millionaires.

Scientific experiments ordinarily demand costly apparatus, and much material, and occasionally the expense entailed is so great as to be practically prohibitive. It is scarcely fair that he who so freely pours his best into the common treasury should be expected to do so at an actual financial sacrifice. We who share the benefit should in some measure share also the burden.

Closely allied with the subject of the fund is that of the Library. This is such a recent addition to the resources of the Association that it is entirely possible that some of you may be as yet unaware that we have a library to discuss. If that be the case, it gives me great pleasure to report to you that through the generosity and untiring efforts of Dr. Curtis and Dr. Harris there has gathered the nucleus of what we hope will in time grow into a complete and in some respects a unique collection of the latest and most valuable literature upon our especial subjects.

Henceforth it will be not only our privilege, but also our duty both as an organization and as individuals to foster in all possible ways this new enterprise. It may be made, and it should be made, a repository of all published matter bearing upon Rhinology, Laryngology and Otology, and as such will be

of invaluable assistance to any one wishing to keep himself
fully abreast of the times.

Besides devoting much time and trouble to getting together
the books, pamphlets and periodicals composing this collection,
Dr. Curtis has set apart a room in his residence as a temporary
home for it; and the matter now on hand is, I understand,
being catalogued and indexed so as to be available for refer-
ence purposes to fellows of the Society.

Later on it should be possible for any member, no matter how
far he may live from New York, to procure data by mail on
the subject he happens to be investigating. But of course, be-
fore we can expect such practical results, we must relieve Dr.
Curtis of the burden he has so unselfishly assumed, and our-
selves provide permanent quarters for the collection. We shall
then need a librarian whose duty it will be to facilitate to the
utmost the use of the books, and who shall moreover be compe-
tent to make the necessary notes and excerpts for the benefit of
those who must avail themselves of the resources of the library
at long range.

There is one other project that I feel impelled to put before
this convention. It has been often in my mind during the last
few years, and now that I have such an excellent opportunity
I cannot resist the temptation to spring it upon you.

It does seem to me, gentlemen, that the time has arrived for
the American Laryngological, Rhinological and Otological So-
ciety to have an organ of its very own—a journal devoted ex-
clusively to the special interests which it represents. I see
nothing impracticable in such an undertaking, nor any reason
why it should not mean for us as much as The Journal of the
American Medical Association does to that body. We have a
number of men who could edit such a periodical with distinc-
tion to themselves and to the Society; and surely there would
be no lack of material. The list of contributors would include
the most notable names in our ranks in Europe as well as in
America, and such a periodical would be the natural and most
efficient means of keeping us in touch with the latest discover-
ies in medical science, and the newest achievements in our own
and cognate branches of surgery. It would present in a con-
cise, readily accessible form reliable information which is now
scattered broadcast through various publications, domestic and
foreign. It would in consequence be a great time-saver, and
that is no small merit in this over-worked age. Few of us have

the necessary leisure to search the mass of periodicals for the grains of wheat that lie hidden in the bushels of chaff.

Such a journal would immediately take its place as a recognized authority, and would be read by every laryngologist, rhinologist and aurist from the Atlantic to the Pacific. They could not afford to ignore it. I am firmly convinced that it would be self-supporting from the start, and as it would be the natural channel for the appearance of the Society's Transactions, it would save us cost of their separate publication which is no insignificant item in our yearly budget. Professionally we have all to gain, and financially there is little risk of loss in inaugurating this new enterprise. Now is the time, and Kansas City (which is a town of beginnings), is precisely the place to bring forth the young stranger for whom I predict a long, honorable and most useful career. I earnestly urge the matter upon your favorable consideration.

It is fortunate for us that there remains, and will always so, much to be accomplished that there can be no danger that the medical profession will be forced to stand still for lack of new worlds to conquer.

On the long, hard road "that winds uphill all the way" every height gained brings more plainly into view the limitless range of peaks yet to be scaled. Nevertheless, the knowledge that we have mounted so far gives us new strength and added courage to press on, and it is well to pause occasionally long enough to measure the distance over which we have lately come.

Twelve years ago, for instance, the science of Otology was, if not in its puling infancy, at least in its backward childhood. It had been traditionally associated with Ophthalmology, and as a result of this incongruous alliance, it had made little or no progress. This Society broke the hampering bonds, and for the first time recognized the natural affinity existing between Otology and Laryngology and Rhinology. Once started on the true road, aural surgery has since gone forward on seven-league boots. We may safely affirm that in no branch of the medical professional has such phenomenal advance ever been made as during the last decade in the surgery of the ear, the brain and the sinuses. And without boasting we can say that on this double-quick forward march the members of the American Laryngological, Rhinological and Otological Society have always been found in the van. No other organization of its age has such a record for original work, and no other has a more

earnest, devoted and courageous band of workers. It is largely owing to the labors of men in our association that American surgery holds the place it now occupies in the eyes of the world. It is no longer necessary as it once was for a young man seeking the best training to go abroad to study, although the added experience and the wider outlook still make such a course advisable when circumstances permit.

But nowhere on the globe can be found more skilful surgeons, more daring investigators or more capable, high-minded and self-sacrificing students of the great problems of biology and pathology than we have right here in our own ranks.

The rapid advance we have made is, however, necessarily attended with dangers. The pitfalls and hidden obstacles that lie in wait for the cavalry corps that attacks the redoubt in a sweeping gallop are no serious menace to the slow-moving infantry that plods after them. Like the famous general of old, the advance guard now and then marches up the hill and then marches down again with no tangible result except perhaps to send the pendulum swinging in another direction; and for this reason it may not be out of place to sound a note of warning.

Courage is a great and a glorious thing. A man who is not brave enough to take all unavoidable risks is not worthy of attaining a great goal. Courage, real courage, examines all sides of a question; it counts the cost carefully, and having once decided it goes forward without haste and without rest to a definite clearly foreseen end.

But between this true and wise courage, and that reckless daring that plays with human life as with a child's toy, that proclaims every operation a success no matter what becomes of the patient, there yawns a gulf as wide and as deep as that which divided Lazarus and Dives.

It sometimes requires less courage to operate than to refrain from operating. It is not always easy for the surgeon to wait until he is at least approximately sure he is right before he goes ahead. So many marvelous things have been done, so many marvelous things remain to do, that our own eagerness aided frequently by the ignorant over-confidence of the patient and of his anxious and well-meaning friends occasionally tempt us to radical measures that we live to regret.

Do not misunderstand me. I am not opposing progress. I am not advocating a return to the dark ages of surgery, when, for example, the bare thought of opening an abscess in the

brain would have frightened both the operator and the invalid into a premature grave; but I am pleading for conservatism in capital operations. Not all movement is forward motion. There is such a thing as going backward; and it is quite possible to keep up a show of violent activity by simply marking time.

Let us then first make sure that we are progressing, and then let us temper progressiveness with judgment. We are not primarily a band of scientists privileged to experiment on human beings to gratify a learned curiosity. We are first and foremost surgeons, and our paramount duty—I am not sure that I ought not to say our sole duty—is to relieve our patient.

With this word of caution, and conservatism comes natural to the man who was born south of the Mason and Dixon Line, I will close and give space to others.

Gentlemen, allow me to thank you for your courteous attention and to express once more my pleasure at seeing you here.

LXVII.

THE DIFFUSE HYPERPLASTIC LARYNGITIS AND PHARYNGITIS OF CONGENITAL SYPHILIS.

By A. Brown Kelly, M. D., D. Sc.,

SURGEON FOR DISEASES OF THE THROAT AND NOSE,
VICTORIA INFIRMARY,

GLASGOW.

The various forms of hyperplasia found in the pharynx or larynx in late hereditary syphilis may be conveniently classified as follows: (1) Hyperplasia associated with ulceration: frequently seen as thickening at the periphery of ulcers or scars. (2) Hypertrophic granulations and papillary excrescences, which may or may not be preceded or followed by ulceration; the condition is oftenest seen on the epiglottis and resembles lupus. (3) Tumor-like hyperplasia. (4) Diffuse hyperplastic infiltration.

I intend to deal here with the last-mentioned variety almost entirely. Owing to the lack of reference to the subject in textbooks on diseases of the throat, an account of the following case may be instructive.

Harry —, aged 7 years, was sent to me in August, 1900, by Dr. J. P. Riddell. Since March of the same year, his breathing had been noisy, especially at night; his speech had become slightly indistinct although the voice remained clear; there had been occasionally scanty epistaxis; and his general health, previously excellent, had suffered considerably. He had no pain or difficulty in swallowing, and there was no history of his having had sore throat.

I found the boy well grown but thin and pale, breathing rather rapidly, with loud stridulous inspirations. On examining his pharynx, the uvula—excepting a small normal portion at the tip—and the mesial part of the soft palate were seen to have undergone marked uniform thickening. The infiltrated area was smooth, pale, and of a hard fibrous consistence, so that the enlarged uvula formed a firm unyielding mass. There was no ulceration. The pharynx was not otherwise involved.

The nose and nasopharynx were normal. The epiglottis was also normal. The arytenoids, on the other hand, were greatly changed and formed two large, pale, smooth masses, which pressed closely together and moved but slightly on phonation and deep inspiration. The upper orifice of the larynx was thus reduced to a small triangular opening between the infiltrated arytenoids and the epiglottis, and was too small to allow of inspection of the parts below. None of the stigmata of congenital syphilis was present.

The condition in the pharynx and larynx was regarded as syphilitic: a view which found confirmation in the family history. The child's father had contracted syphilis, but the mother had never manifested any signs of the disease. She had had two miscarriages and eight children, five of which died in infancy. All the children when a few weeks old had presented eruptions, some of which, e. g., pemphigus, were undoubtedly specific. My patient when an infant had ailed intermittently, and mercurial inunctions and grey powder had been administered for "spots" on his skin. Since he was six months old, however, he had been well until the onset of the laryngeal symptoms above described.

Mercurial inunctions and subsequently iodid of potassium were prescribed with the result that his general health improved, and his breathing became slowly less noisy. Six months after coming under observation, the respiration was quiet, the infiltration of the palate was much less, and the entrance to the larynx was slightly freer although considerable stenosis still persisted, as is shown in the drawing (Fig. 1.) which was made at this date. The patient was examined two years later and the appearance were practically unchanged.

After he had been two months under treatment, the greater part of the enlarged uvula was removed, and submitted to Dr. A. R. Ferguson, now Professor of Pathology, Medical School, Cairo, whose report on its microscopic structure follows: "The uvula (submitted entire) was divided by a median longitudinal incision, fixed in saturated solution of corrosive sublimate, and embedded in paraffin in the usual manner. Sections were prepared parallel to the cut surface and included the entire uvula. The nuclear stain employed was Mayer's haemalum, and eosine, eosine and orange, and Von Gieson's fluid were used in combination with this. The microscopical characters are as follows:

"Low Power.—The epithelium is increased in thickness. There is a well-marked keratinous layer which at parts has quite a corneous character. No stratum lucidum is visible. The papillæ of the Malpighian layer are in the main well preserved and the columnar layer of cells proper to this layer is observed throughout. The basilar membrane is well seen at parts, and where invisible is rendered so by inflammatory changes beneath. Practically the whole sub-epithelial zone of tissue is occupied by a very cellular granulation tissue in which at parts dense collections of leucocytes apparently are visible. In this zone, which does not extend very deeply, the vessels are of small size and very numerous. The more central portion is composed largely of a fairly fibrillated and rather scantily
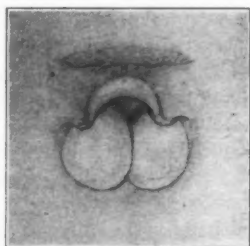
Fig. 1.

ulcerated nucleated connective tissue, in which are visible the lumina of vascular channels. These latter are less abundant here than in the sub-epithelial inflammatory zone noted above. They are in every case either surrounded by, or in close lateral relation to, dense clusters of cells possessing the characters of those seen in granulation tissue. There is a considerable amount of mucous gland tissue present towards the base of uvula. The acini, which appear normal in every respect, are lined by columnar cells with completely distended or ruptured walls. The irregular cellular infiltration noted round the vessess is entirely absent from the interstitial tissue of the glands."

"High Power.—The corneal layer is relatively broad with

elongated narrow nuclei; the stratum granulosum is reduced to a single layer with the characteristic appearances. The cells of the Malpighian layer are somewhat compressed and where the epithelial covering is thinnest are interrupted by leucocytes apparently making their way towards the surface. The tissue immediately beneath possesses generally throughout the characters of a fairly vascular granulation tissue, the degree of cellularity of which varies very considerably. In the less cellular parts, the oval or spindle-shaped cells met with in organizing connective tissue are comparatively abundant. In the more richly cellular portions, the nuclei are small and rounded and more resemble those of lymphocytes. The ground substance of this tissue is either homogeneous or very faintly granular and shows no fibrillation. The sub-epithelial zone in which this tissue occurs is nowhere extensive and passes rather abruptly into richly fibrillated and rather sparsely cellular connective tissue. The cellular areas around the vessels in the central parts of the uvula consist of leucocytes and young connective tissue corpuscles with a scanty and finely fibrillar intercellular matrix. There are nowhere appearances of arterial thickening or of endarteritis."

It should be mentioned that the microscopic appearances just detailed resemble those of subglottic hypertrophic laryngitis, and of sclerotic hyperplasia, as pointed out in a paper on the latter affection published in the *Lancet*, 6th of April, 1901.[1] The microscopic examination of the uvula from the man with sclerotic hyperplasia differed from that of the child's uvula in the above case of congenital syphilis in the following respects: 1. The epithelial covering in the man's uvula was compressed, thin but dense, and without papillæ; in the child's it was increased in thickness, and the papillæ were marked but not exaggerated. 2. The granulation tissue zone beneath the epithelium in the adult was more irregular, less cellular, and with less inflammatory elements. 3. Slight whorling of the connective tissue surrounding the arteries in the man's uvula. 4. Marked inflammatory infiltration of the glandular interstitial tissue in the man's uvula, which was completely absent in the child's.

The features worthy of special attention in the case of congenital syphilis reported above are: 1. The uniform and symmetrical character of the infiltration. 2. The absence of ulceration. 3. The tendency of the infiltrated region to become

edematous and produce more or less laryngeal stenosis. 4. The persistence of the hyperplasia in spite of anti-syphilitic treatment.

In several of these respects, a contrast is presented to the appearances usually observed, and the course commonly followed in hereditary syphilis. I have been able to find records of only a few similar cases which, given in an epitomized form below, may assist in the conception of the clinical picture. The first three were reported by J. N. Mackenzie[2] in an excellent monograph on congenital syphilis of the throat under the term chronic interstitial laryngitis.

1. Boy, aged 15 years, suffered from dysphagia, hoarseness and slight dyspnea. Considerable destruction was found in pharynx due to ulceration. Epiglottis was greatly thickened; and aryepiglottic folds, arytenoids and venticular bands were swollen. No signs of ulceration and no cicatrices. The uniformly thickened laryngeal membrane presented a dull, lustreless, pale-red appearance. Three months later the hyperemia was less but the hypertrophy remained unaltered.

2. Girl, aged 12 years, presented ulceration and necrosis of palate, and cicatrices in pharynx. The mucous membrane of the larynx was uniformly thickened and hyperemic. Three months later the ulceration was healed and patient cured. The thickening of the laryngeal membrane remained unaltered, but its congested condition had disappeared.

5. Syphilitic child. Ulceration of tongue. Uvula and greater part of soft palate destroyed. The mucous membrane of the entire larynx was uniformly hypertrophied and presented a dirty, yellowish-red appearance. The vocal cords were swollen, sluggish and congested. The child was rapidly improving under iodid of potassium.

4. Jacob's[3] Case. A child from a fortnight after birth presented manifestation of congenital syphilis. When about five months old, cough and huskiness set in, and larnygeal obstruction soon supervened demanding tracheotomy, but the child died. At the necropsy no marked change was observed in the upper compartment of the larynx, but below the cords the lumen was reduced to a mere chink by swelling and thickening of the mucous membrane, which extended about three-quarters of an inch downwards. Microscopically, the thickening was seen to consist of a mucous membrane greatly thickened by interstitial deposit of connective tissue, as well as

by hypertrophy of the gland tissue. There was an entire absence of ulceration.

5. Eröss's[4] Case. Child, aged 3½ years. Hypertrophy of mucous membane of entire larynx. Epiglottis depressed, thickened to three or four times its normal, and horse-shoe shaped. Aryepiglottic folds and left false cord greatly thickened, the latter bulging at the middle and dark red.

6. Compaired's[5] Case. Boy, aged 5½ years, had had hoarseness, cough and noisy respiration for over five months. On several occasions suffocation threatened. In the larynx, there was a generalized hypertrophic state of the mucous membrane affecting chiefly the aryepiglottic folds.

The above reports show that the laryngeal appearances of diffuse hyperplasia warrant special attention on account of their rarity, and their liability to be wrongly diagnosed. Errors are especially apt to arise when, as in my case, no other sign of congenital syphilis was present, and the condition was acute.

It must be remembered, however, that while it may be convenient clinically to distinguish between circumscribed and diffuse hyperplasia, with and without ulceration respectively, no strict classification of this kind is possible, for the various conditions may be associated or may pass into one another. Thus, in my patient the use of the laryngeal mirror sometimes caused minute hemorrhages from the thickened palate, a fact which taken in conjunction with the microscopic aspect of the uvula showed that ulceration of the surface might readily have occurred.

The association of diffuse hyperplasia with superficial ulceration has been observed by Semon[6], who was probably the first to direct attention to this particular manifestation of congenital syphilis of the larynx. In 1880 he showed, at a meeting of the Pathological Society, of London, the larynges of two brothers who had been subjects of congenital syphilis, and had died within three weeks of each other of the same acute complication of the primary disease, namely, acute laryngeal edema. In the case of the older boy, aged 5¾ years, the entire larynx presented a general hyperplastic change with superficial ulceration. The hyperplasia was especially marked in the epiglottis, the aryepiglottic folds and the interarytenoid fold; there was also acute edema of the epiglottis and aryepiglottic folds. The chronic thickening and acute edema caused the opening into the larynx to be so narrowed as scarcely to admit the tip of

a lead pencil. The true and false cords were destroyed by
ragged ulcerations. The larynx of the younger boy, aged 3½
years, presented acute edematous infiltration of the vocal cords,
ventricular bands and interarytenoid fold. The aryepiglottic
folds were less infiltrated, and the epiglottis had nearly es-
caped. In both cases there were numerous shallow ulcerations
of the mucous membrane in the interior of the larynx, but in
the younger boy the chronic changes were less, and the acute
ones more developed than in his brother.

Further, the hyperplasia may at any time become the seat
of a gummi, or circumscribed hyperplasia may be present in
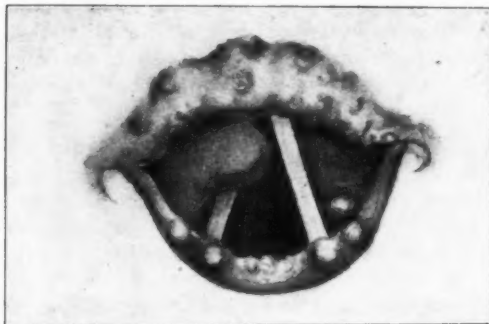
Fig. 2.

one part of the larynx and deep ulceration or cicatrization in
another. A comparatively large number of such cases has been
described and collected by J. N. Mackenzie, Strauss[7] and
others. The accompanying drawing (Fig. 2) depicts the
permanent laryngeal appearances in a case falling under this
category. The upper part of the epiglottis is gone, the re-
mainder is much infiltrated and scarred; the posterior wall is
irregular; a tumor-like projection passes from the right false
cord and prevents the perfect approximation of the vocal cords.
Specific treatment produced no effect on the size of this out-
growth, and the resistance offered by its hard texture was such
as to render impossible its reduction by ordinary laryngeal
cutting forceps.

Congenital syphilis of the larynx must be regarded as an affection of extreme gravity if one may judge from the large proportion of reported cases that has died of suffocation or been rescued from death by tracheotomy. Even after the patient has been under treatment and is comparatively free of danger, edema may rapidly develop and cause suffocation. Sturge's lost a boy who had been treated for seven months with benefit. One day the child was on his way to the hospital when a somewhat violent gust of wind seemed to take away his breath (spasm) and he died before assistance could be rendered. Diffuse hyperplastic changes in the larynx are probably those that menace life most. Such at least, is J. N. Mackenzie's opinion, and support is afforded it by the death of Jacob's, and of both of Semon's cases, and by suffocation threatening several times in Compaired's patient and my own. The latter on one occasion was sent hurriedly to the infirmary to have tracheotomy performed, which was rendered unnecessary, however, by the subsidence of the edema.

In a number of the cases recorded of congenital syphilis of the larynx, the pharynx has also been involved. As a rule, there had been ulceration leading to destruction of less or more of the palate, uvula, faucial pillars, etc. In a few instances, however, the manifestations resembled rather those in my patient. Thus, in one of Semon's patients the uvula was thickened and congested, and in Strauss' first case the uvula was thickened and presented a superficial plaque-like ulceration.

In tertiary syphilis, hyperplasia may occur secondary to ulceration as granulations, papillary excrescences and tumor-like formations, which may or may not be preceded by ulceration, and as subglottic hypertrophic laryngitis. On the other hand, the diffuse symmetrical hyperplasia of congenital syphilis involving the supraglottic regon has no counterpart in tertiary syphilis. This would seem to form a distinction between acquired and inherited syphilis which possibly arises from differences in the tissues of the two classes of subjects.

It should therefore be kept in view, that a symmetrical hyperplasia of the laryngeal mucous membrane, unaccompanied by ulceration, may appear as a manifestation of congenital syphilis in a patient presenting no other sign of the diathesis, in whom only slight improvement is obtainable by anti-syphilitic treatment.

REFERENCES.

. 1.   Kelly, A. Brown—Sclerotic hyperplasia of the Pharnyx and Nasopharynx.   Lancet, 1901, I, p. 995.

2.   Mackenzie, J. N.—Congenital Syphilis of the Throat. Amer. Jour. of the Med. Sciences, Oct., 1880, p. 321, et seq.

3.   Jacob.—Lancet, 1887, I, p. 420.

4.   Eröss.—Jahrbuch f. Kinderheilk., XV, S. 139.

5.   Compaired, C.—Laryngite hypertrophique syphilitique. Annales des maladies de l'oreille, etc., 1889, I, p. 353.

6.   Semon, F.—Two cases of Congenital Syphilis of the Larynx. Trans. of the Path. Soc. of London, Vol. 31, 1880, p. 41.

7.   Strauss, H.—Ueber Lues tarda Laryngis im Kindesalter. Archiv. f. Kinderheilk., Bd. 14, S. 312.

8.   Sturge, W. Allen.—Ulceration of the Larynx due to Congenital Syphilis.   Trans. of the Path. Soc. of London, Vol. 31, p. 39.

LXVIII.

COUGH IN DISEASES OF THE RECURRENT NERVE.

By Prof. Gerard Ferreri,

ROME.

The pathologic physiology of the recurrent nerve will, for some time to come, give many occasions for animated polemic discussions, until anatomic studies and experimental clinical researches decide conclusively whether this nerve is exclusively motor or of a mixed nature. It is owing to a work of Burkhardt, which appeared in 1868, that the dispute again arose, and the number of those who believe that the recurrent nerve is made up of centripetal and centrifugal fibres has greatly increased, their opinion being backed by numerous experiences (Pflüger, Valentine, Krause, Réthi, Masini, Onodi, etc.).

It would be too difficult a task for me, at this moment, to give a decisive judgment on the subject, not having had conclusive personal physiologic experience. I do not think it labor lost, however, to put forth some objections with regard to the motor nature of the recurrent nerve, basing my claims upon some clinical observations of patients suffering from aortal compression of the recurrent nerve. The principal symptoms upon which we base our diagnosis of this lesion are those of mobility, as revealed by the laryngoscope, such as clonic spasms, contractions and the paretic and paralytic state of the cords. But these are not the only symptoms, and among others we must reckon with two phenomena, which are not very rare, viz., pain and cough.

Thus far, physiologists and the clinicians have studied chiefly the motor rather than the sensitive innervation of the larynx.

The experiments upon the recurrent nerve producing when cut or lacerated a Wallerian degeneracy of the nervous fibres and cellular modifications in the bulbar centres (chromolysis), established that it is exclusively motor, that the innervation of the larynx comes from the bulbar roots of the vagospinal nucleus, and that, in short, the bulbar centre for the larynx is found in the dorsal vagospinal nucleus of the pneumogastric.

According to the most recent researches in anatomy, only the motor fibres of the pneumogastric, arising from a long grey mass situated in the bulb (dorsal motor nucleus), would play a part in the constitution of the trunks of the recurrent nerve while the spinal nucleus (eleventh pair) would take no part whatever in laryngeal innervation. Admitting as already proven that the trunk of the recurrent nerve is only motor, the different diseases which can attack it (i. e., rheumatism, compression, neuritis) should yield nothing but a very simple symptomatology, depending upon the irritation, or upon the paresis or paralysis of this nerve.

The exclusively motor nature of the recurrent nerve therefore, can give an almost mathematical explanation of the mechanism of the different positions of the vocal cords in cases of lesions of this nerve, as we see by the reflections on the laryngoscope. But such is not the case when we wish to account for the other symptoms which sometimes accompany lesions of the recurrent nerve, such as the phonetic and respiratory disturbances, and those which sometimes precede the lesion or which may be the only symptom found, e. g., the cough.

It is in such cases that the question becomes a veritable Gordian knot.

With regard to the pain, in the larynx as in any other part or organ, it is anything but a precise diagnostic sign; rather, all pain is purely a subjective phenomenon, whose gravity it is impossible for the physician to rate or estimate; it is extremely difficult to determine how much of this troublesome

sensation is due to the disease and how much is due to the greater or less impressionability and susceptibility of the patient.

Some there are who wish to attach too much importance to pain as a symptom. It is true that very often it is the symptom of the disease and the stimulus which leads the patient to consult a physician. It is equally certain that now and then it is the symptom which most troubles the sufferer and for which he seeks a speedy cure; but there is a great difference between considering this as a pathognomonic sign of the gravity of the disease and of wishing to establish it as a positive diagnostic element of disease of the larynx.

Pain is entirely individual, and each one feels it according to his special physical constitution; what may cause unutterable suffering to. one person may easily be borne by another. Munnkoppf thought that pain could be diagnosed objectively, basing his opinion upon the variatious which pain produces in the frequency and rhythm of the arterial pulse; but such a phenomenon is not constant, being more or less accentuated according to the circumstances which render the individual more or less sensible to pain; therefore, experience is, in the same manner, useless, for it cannot succeed even in detecting simulation, inasmuch as the psychical tension, in which the simulation is found at the moment of examination, is of itself capable of producing Munnkoppf's sign. in which case it would truly be positive without any pain, and so every attempt at an objective diagnosis of pain is useless.

Pain is entirely subjective, and we must content ourselves with making a relative estimate of it, for there are no sphygmograph and no spirometer that can record it; each one feels and suffers in his own individual way and science can establish nothing positive about it. And so from a clinical point of view, this is a great loss, since in many cases it would be sufficiently interesting to be able to establish something definite as regards this diagnostic element in affections of the larynx.

Often the slightest affections of the throat occasion the

most acute pain, while, generally speaking, grave affections (such as syphilis, tuberculosis, cancer) and all kinds of compression of the recurrent nerve, continue to run on without pain, in the majority of cases.

To return now to our discussion of the laryngeal disturbances caused by aortic compression of the recurrent nerve. I remember a patient who was under my treatment for a long time, and although he suffered continually from a pain in the larynx, upon examination with the laryngoscope not the least trace of a change in the position of the cords was found, and in the end he died suddenly of a saccular aneurysm of the aorta. This is a case that could uphold the old theory of Long and Lushka, that the recurrent nerve contains sensitive fibres, also, coming perhaps from the superior laryngeal through the medium of the anastomosing filament called "the bundle of Galen."

According to Kandoresky, the sensitive anastomotic fibres are divided into two bundles, one of which remains under the control of the inferior laryngeal, while the other— the more bulky bundle—leaves the trunk of the recurrent nerve and is distributed to the tracheal mucosa.

In conclusion, to my mind the pain which patients sometimes complain of in the first stages of compression of the recurrent nerve is occasioned by an irritated condition of the sensitive peripheral fibres of the larynx, above all of the healthy part, which is called upon to perform a greater functional labor in order to compensate for the reduced activity of the other part, which is hindered by increasing neuritis of the recurrent nerve.

But the gravest symptom, and at the same time the most difficult to explain, is the cough, without any phenomenon of altered mobility, which very often is the beginning of phonetic and respiratory disturbances in persons affected with aortic atheroma, or with dilatation and aneurysm of the arch, and which, in some cases, is the only disturbance that admits of relief.

How can this be explained? How can the origin of the different impulses of this reflex act be determined? Physiology treats it in a very few words, saying that cough is an act caused by the exciting of the peripheral ramifications of the superior laryngeal nerve in the laryngeal mucosa or of its central stump after resection. But here again, it must be remembered that, for the most part, in phonetic respiratory disturbances caused by compression of the recurrent nerve, the sensitiveness of the laryngeal mucosa is greatly diminished, so much so that a probe can be introduced into the larynx through the glottis without producing any reflex acts and without the need of any anesthetic.

Now, in cases of compression of the recurrent nerve, which most writers consider exclusively motor, the laryngeal cough region, innervated by the superior laryngeal nerve, atrophies according to the more or less pronounced compression which the aorta exerts upon the recurrent nerve; therefore we must seek some other explanation of this reflex act, which, as we have already stated, is now and then the only symptom of compression of the recurrent nerve.

If it were indeed true, as I personally think it is, that by the excitation of the central portion of the inferior laryngeal, a contraction of the expiratory muscles would be produced, it would be proved without the need of any further demonstration, first, that the recurrent nerve itself distributes a number of sensitive fibres to the mucosa of the trachea; secondly, that the cough can not only be dependent upon the irritative lesion of the superior layngeal, but also is in direct relation with the parenchymatous neuritis of the recurrent nerve.

Of course, in order to conclude that central excitation of the recurrent nerve acts upon the larynx, there are wanting further facts which must be determined by study of the small cells in a state of chromatolysis in the jugular and nodal (plexiform) ganglia of the pneumogastric, where all

the sensitive fibres contained within the trunk of this nerve come together.

To strengthen the judgment just expressed as to the importance which must be attached to cough as a symptom of compression of the recurrent nerve, and as a sufficiently valid index to the mixed nature of this branch of the pneumogastric, I subjoin a few illustrative cases, of three of which I can furnish radiographic proofs.

Case I.—A. B., already passed his 57th year, states that in his tenth year he had a syphilitic infection which was regularly cured; he has always enjoyed good health, but during the last six months has been suffering from shortness of breath in walking upstairs, and has been troubled with a cough which comes on continually in starts or jerks and which becomes excessive upon moving the neck quickly, especially when lying down. The patient refers this cough to the throat; the slight expectoration coughed up is streaked with blood owing to the great effort made. An examination of the thorax reveals a distinct dullness in the region of the aortic arch, while the image upon the laryngoscope shows a simple diffused hyperemia of the cords. The patient never had any phonetic disturbances and died after two months from the rupture of an aneurysm.

Case II.—P. C., 37 years of age and a heavy drinker, about nine months ago began to suffer from a cough brought on by a tickling sensation in the throat, to which was added a slight hoarseness after two months. An examination with the laryngoscope showed the left vocal cord immovable and in an intermediate position between the phonetic and respiratory state.

Case III.—A. N., 49 years of age, has never had any ailment to amount to anything. However, fifteen years ago he contracted syphilis but was regularly cured. For the past three months, he suffers from a dry, irritating cough, which is especially pronounced after the least effort. An examina-

tion with the laryngoscope shows the glottis in a normal condition, except a slight hyperemia of the cords, due in all probability to the fits of coughing which for the past fifteen days have become more frequent and more troublesome; there is no trace of motor lesions of the left half of the larynx, while the radiograph, here shown, reveals an ectasia of the aortic arch (Fig. 1).

Case IV.—O. F., 59 years of age, has always enjoyed good health; though somewhat slender from girlhood, the last two years she has inclined to obesity. She has given birth to numerous children and absolutely excludes the suspicion of syphilis.

For about two years she has been tormented with an insistent, irritating cough, which lately has come on in such paroxysms as to render repose during the night impossible; morphin, codein, etc., taken in large doses, can scarcely stop the paroxysms and then for a short time only.

Lately, the characteristic symptoms of gout have manifested themselves in her hands and feet. A radiograph revealed a pronounced lesion of the aortic arch. The image on the laryngoscope was in nowise able to aid in determining the cause of the cough, since in the position of the vocal cords there were not the disturbances which constantly accompany a lesion of the recurrent nerve.

The radiograph here shown (Fig. 2) reveals to a certainty a most pronounced lesion of the arch of the aorta.

Fig. 1.
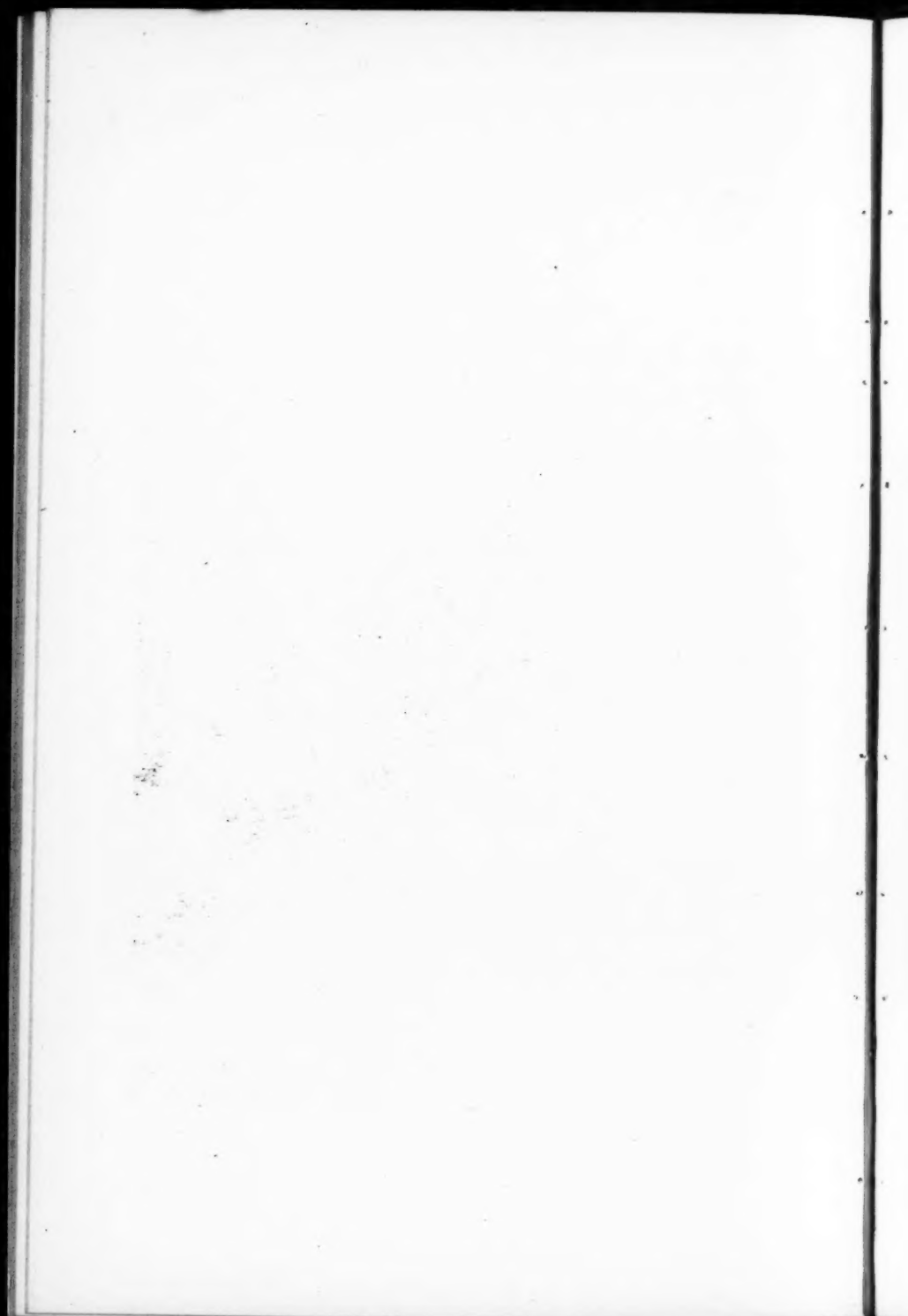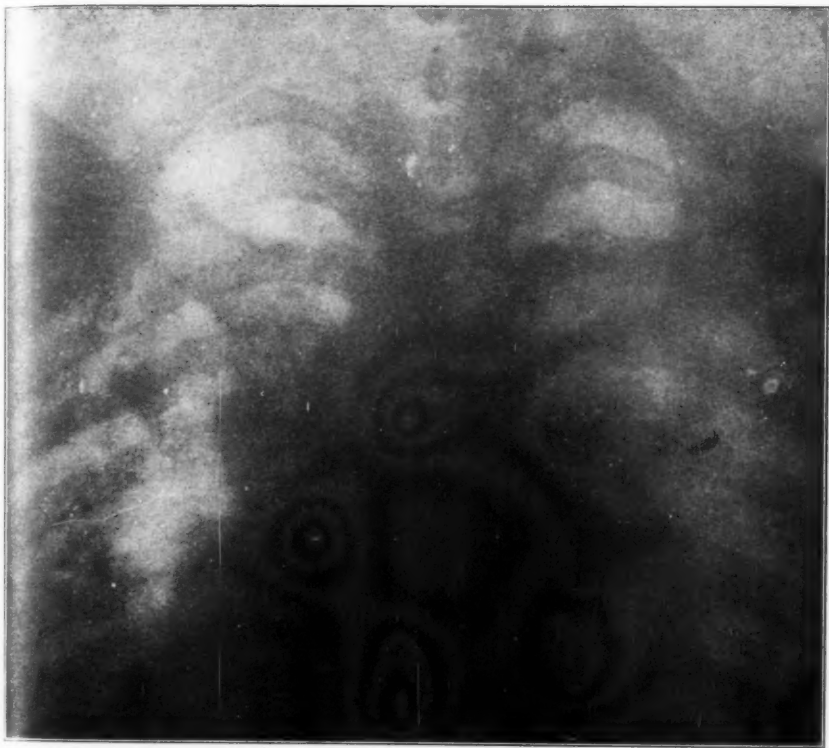
Fig. 2.
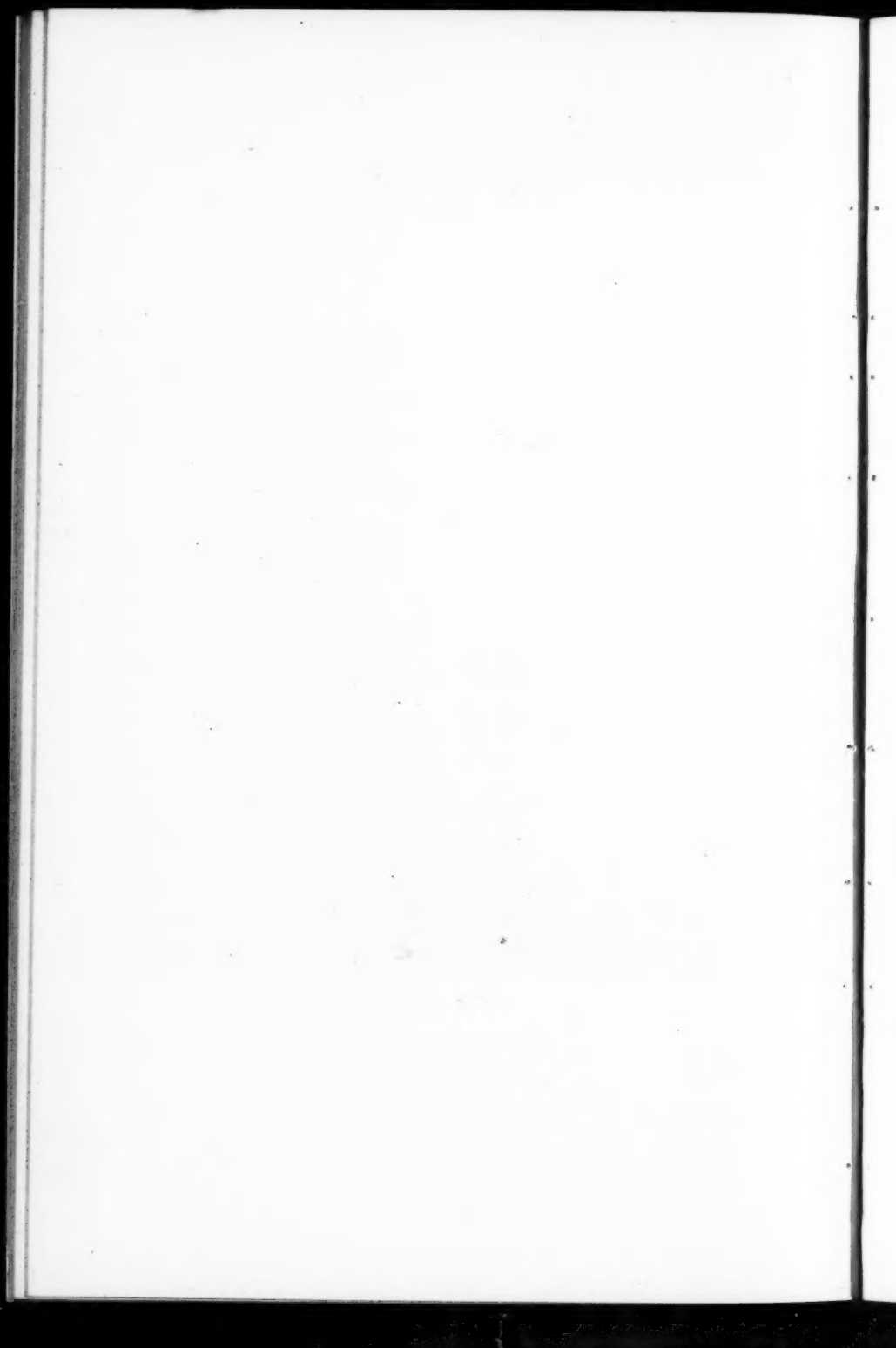
LXIX.

A CONTRIBUTION TO THE DIFFERENTIAL DIAGNOSIS OF CERTAIN MALIGNANT DISEASES OF THE LYMPHOID TISSUE OF THE THROAT.

By J. L. GOODALE, M. D.,

ASSISTANT IN LARYNGOLOGY IN HARVARD MEDICAL SCHOOL.

BOSTON.

In the following paper, I wish to bring to your attention a group of affections of a malignant character, with localization in the pharynx and nasopharynx. These conditions are recognized in literature as pseudoleukemia, lymphosarcoma, malignant lymphoma and sarcoma.

Much confusion exists in literature with regard to the divisions between these conditions. Mamlok in 1899 reported a case to which he gave the name of malignant lymphoma, and discussed the differential diagnosis between this condition and sarcoma. By malignant lymphoma of the tonsil is denoted a condition characterized by proliferation of the lymphatic elements of the organ, passing secondarily to the neighboring lymph nodes, not extending below the territory of these structures, and characterized histologically by an atypical increase in the numbers of lymphoid cells, and of the connective tissue framework. By sarcoma of the lymph glands is denoted a condition characterized by infiltration in the tissues of round cells or spindle cells, showing a tendency to break through the capsule of the organs, and invade the neighboring structures.

Simmons, in 1903, distinguished between pseudoleukemia and lymphosarcoma or sarcoma. The former differs from the malignant growth in that only one kind of tissue is attacked, the lymphadenoid, and it does not infiltrate or tend to extend from one group of glands to those in continuity. In the metastases in the liver, lungs and other places, it can be explained as a disease attacking the small amount of lymphoid

tissue normally present in these organs. He concluded that pseudoleukemia, or, as he prefers to say, Hodgkin's disease, should be regarded as an entity presenting a definite histologic picture. It has no relation to leukemia or tuberculosis, although the latter may be co-existent.

Sternberg, on the other hand, regards the disease as an atypical form of tuberculosis, and has reported a series of thirteen cases where Hodgkin's disease was established clinically, in eight of which lesions of tuberculosis were present at autopsy. While it is not infrequent to find tuberculosis in patients with pseudoleukemia, yet the weight of opinion now is in favor of regarding it as secondary infection, occurring in a debilitated individual.

In the following series of cases, it will be seen that the distinction between malignant lymphoma and pseudoleukemia is not possible to define. Sarcoma of the lymphadenoid tissue represents, on the other hand, a comparatively well-characterized morbid state.

Case I. A patient, 15 years of age, was seen May 13th, 1904, in consultation with Dr. Atkins of Holliston and Dr. Palmer of South Framingham, for enlargement of the right tonsil. The patient was large, well developed and unusually strong for his age. His throat had been perfectly well until four months before, when a short attack of tonsillitis occurred, followed by progressive enlargement of the right tonsil, together with swelling of the cervical nodes on the same side. There was no pain or discomfort. Examination showed the right tonsil to be the size of an English walnut, not adherent to the pillars, protruding to the median line, showing several crypts moderately dilated in its upper half, but no crypts over the anterior aspect of the lower half. The color of the organ was somewhat more bluish than normal. The cervical nodes on the right side below the angle of the jaw showed moderate enlargement, ranging from the size of a pea to a hickory nut, freely movable under the skin, and not tender on pressure. No glandular enlargement elsewhere was noted. The right tonsil was removed with the snare, and examined histologically. The tonsillar tissue was found to be replaced by a compact aggregation of small round cells, contained in the meshes of a fine network of connective tissue, lined with endothelial cells. The round cells had

approximately the size and shape of mononuclear lymphocytes, and were disposed with regularity. There was no evidence of follicles. Examination of the blood showed no alteration in the size or shape of the cells. The white were essentially normal. The site of the operation healed in about two weeks. The patient was given Fowler's solution in increasing doses during the following three months. Examination August 30th, 1904, showed no lymphoid tissue apparent at the former site of the right tonsil. The cervical nodes had diminished slightly during this time. The patient felt and looked very well. On October 12th the nodes showed a continued diminution in size.

In February, 1905, the patient was taken by sore throat, characterized by pain and reddening of the pharynx, especially on the right side. The nodes simultaneously became larger. This inflammation diminished slowly during the following month, but the nodes in the neck began slowly to enlarge. His color and general condition were not so good, and the arsenic was not well-borne. This was consequently omitted, and the patient was given iron and quinin with other tonics. From this time until December, there was progressive loss of color and strength, and the nodes on the left side of the neck began slowly to enlarge. Examination of the blood at this time showed hemoglobin 70 per cent, whites 14,700, reds 3,840,000. Stained specimens showed increased variation in size of the red cells. White cells were not remarkable. In April, 1906, glands appeared in the axilla and groins, and a more rapid failure in strength was apparent.

Case II. A man, 42 years of age, seen Nov. 16, 1905, in consultation with Dr. Twitchell of Boston, gave the history of recurrent sore throat for many years, somewhat relieved by excision of a portion of the tonsils two years before. Since then, he had been well until two months ago, when the right tonsil became enlarged, together with the cervical nodes on the right side, progessively increasing. Examination showed the right tonsil and circumtonsillar region enormously swollen, passing beyond the middle line of the uvula. The free surface of the tonsil is relatively small, being two centimeters in transverse diameter, most of the tonsil being evidently covered by the anterior pillar. The tonsillar surface itself is markedly reddened with finely granular surface, denoting

ulceration. A portion of the tonsil was excised, and showed on histologic examination numerous closely appressed round cells, having the character of lymphocytes, contained in a fine fibrous reticulum, lined with endothelial cells. There was no evidence of follicles in the specimens. Examination of the blood showed nothing noteworthy beyond a slight anemia. The right cervical nodes were enlarged to the size of two fists, causing marked distortion of the neck. The left cervical nodes were enlarged to the size of two pigeon's eggs, and the posterior cervical nodes to the size of peas. No enlargement of the lymph nodes was found below the clavicles. The spleen was not enlarged. The patient was put on increasing doses of Fowler's solution, with marked improvement for a time in every way. The tonsillar and lymphoid enlargements became progressively smaller. After three months, however, the nodes again became enlarged, and the right tonsil increased in size. Examination June 15th, 1906, of the blood showed no increase in the number or proportion of white cells, and no essential deviation from normal in the red cells. The swelling in the throat had by this time increased to such an extent as to interfere with respiration, the right tonsil passing far beyond the middle line, while the posterior pharyngeal wall exhibited a marked infiltration of a comparatively soft character, apparently due, so far as could be determined by palpation, to the enlargement of the pharyngeal follicles. The surface of the tonsil showed a friable, easily-bleeding, fungus mass. Suffocation was threatened and it was decided to remove, if possible, a portion of the obstructing right tonsil. Early in the etherization, however, respiration ceased, and tracheotomy was immediately performed, followed by artificial respiration. By the insertion of a tracheotomy tube, the patient breathed comfortably, and during the following two weeks gained considerably in color and strength. Death occurred early in July, from a sudden suspension of the heart's action.

Case III. A man, 62 years of age, was seen September 1906, for enlargement of the left tonsil. In January of this year, he first noticed pain on the left side of the throat, associated with progressive enlargement and difficulty in swallowing. There was no swelling externally until two weeks ago, when some lumps were felt under the angle of the left jaw. Examination showed the site of the left tonsil to be

occupied by a mass about the size of a pigeon's egg, covered anteriorly by the reddened, smooth mucous membrane of the anterior pillar, and presenting behind the aspect directed toward the median line an ulcerated surface with a finely granular irregular floor, here and there covered with necrotic detritus, moderately firm on pressure and easily bleeding. The cervical glands under the left angle of the jaw ranged in size from that of a pea to a hickory nut. A portion of the tonsillar growth was removed for microscopic examination and examined histologically. The report of Dr. Simmons showed the specimen to consist of "a small piece of tissue 1 cm. in diameter from the tonsil. This was covered on one side by apparently somewhat thickened mucous membrane. The rest of the substance was composed of soft grayish white, somewhat friable tissue, in which were one or two small hemorrhagic areas. Microscopic examination showed the tissue very cellular and composed of masses of round cells closely packed and separated in a few places by fine bands of fibrous tissue. The cells had small, rounded but somewhat vesicular nuclei, and an extremely small amount of protoplasm. In places were irregular necrotic areas in which the nuclei had undergone fragmentation. This tissue was covered by normal stratified squamous epithelium. Diagnosis: Round cell sarcoma."

Case IV. A boy, 4 years of age, was seen March 2, 1900, for tonsils and adenoids. Examination showed the left tonsil to be exceedingly hypertrophied, passing beyond the uvula, and coming into contact with a moderately enlarged right tonsil. On palpation a large amount of adenoid tissue was felt in the nasopharynx, chiefly on the left side, a fact which was considered somewhat remarkable at the time, but did not lead to suspicion of anything beyond an ordinary lymphadenoid hypertrophy. The soft palate above the left tonsil was somewhat more prominent than the corresponding spot on the right. Under ether, both tonsils were removed, together with a large adenoid mass from the left side of the nasopharynx. A large retropharyngeal mass was felt on the left, below the surface of the mucous membrane, suggesting at the time a glandular enlargement. The child recovered from the operation uneventfully, and was able to breathe comfortably through the nose for several weeks, when examination showed an enlargement again in the naso-

pharynx at the site of the mass which had been removed. This was again excised, and found histologically to be a lymphosarcoma, the tissue consisting of masses of round cells, closely aggregated and obliterating the ordinary adenoid tissue. The child, who had previously appeared of good color and reasonably well-nourished, began at this time to lose distinctly in strength and flesh. Examination of the blood showed it to be essentially normal except for a moderate anemia. During the following two months the combined serum of streptococcus pyogenes and bacillus prodigiosus was administered, at first with apparently beneficial results. During May, the mass in the nasopharynx began again to enlarge, and interfere with respiration. On examination at this time the retropharyngeal wall was seen to protrude forward about one inch from its normal situation, particularly on the left side, with the result of interfering materially with deglutition and respiration. Tracheotomy was done and the condition of the patient relieved so far as comfort was concerned, but a progressive loss of strength continued, and death occurred early in June. During this time examination failed to disclose enlargement of the glands in other situations.

Summary of Cases: In Case I we see progressive enlargement of one tonsil, without ulceration, associated with swelling of the adjacent lymph nodes, followed by a general involvement of lymphadenoid tissues in other situations, giving finally a characteristic picture of Hodgkin's disease.

Case II is characterized by an initial enlargement with early ulceration of one tonsil and involvement of the adjacent lymph nodes, running a comparatively rapid course, terminating in a genuine Hodgkin's disease.

Histologically, these cases were characterized by proliferation of the endothelial cells of the reticulum, and of the center of the follicles, in association with numerous lymphoid cells, disposed without characteristic arrangement. In contrast with these, Cases III and IV exhibit alteration of the tonsils and adenoid respectively, and of the adjacent lymph nodes, without involvement of the lymphadenoid tissue in other situations. Histologically, these cases differed from Numbers I and II in the character of the cells, these being chiefly small round cells, with a comparatively small amount of intervening reticulum.

Case I would be classed at the outset as malignant lymph-

oma, and this would also be true of Case II, except for the early appearance of ulceration, which is commonly considered absent in this affection. It does not seem probable that the ulceration here can be regarded as a pressure necrosis, since it appeared before the disease had attained sufficient size to press upon the neighboring parts. It is possible, on the other hand, that the extremely rapid growth caused a thinning of the superficial epithelium with the result that abrasions were easily excited by the ingestion of food. Whatever the cause, it is sufficient to note the fact of the early loss of substance on the surface of the growth.

A consideration of these cases shows that Hodgkin's disease may begin in the lymphadenoid tissue of the throat, remaining there limited for a considerable time, before the development of manifestations in other organs. While such early local lesions may be considered identical with those occurring in cases described as malignant lymphoma, yet it would be more exact, and confusion better avoided, if such conditions were designated simply as Hodgkin's disease or pseudoleukemia originating in the tonsil. The term malignant lymphoma would, therefore, be best entirely dropped from literature. As stated by Simmons, and as confirmed by these observations, these early manifestations of pseudoleukemia differ from sarcoma in that the process proceeds by extension from one group of nodes to those in contiguity, and that only one kind of tissue is attacked, namely lymphadenoid. The metastases in the liver, lungs and other places can be explained as the disease attacking the small amount of lymphoid tissue normally present in these organs.

The term lymphosarcoma has been applied to conditions identical with those described in Cases I and II, but clearly on improper grounds, since these enlargements are not malignant in the sense of attacking other organs in the vicinity, nor are they composed exclusively of lymphocytes.

It is but fair to say, however, that some competent observers do not consider that a sharp line of demarkation exists between the group of new growths known as malignant lymphoma and pseudoleukemia, on the one hand, and lymphosarcoma or sarcoma on the other hand. While it may be shown eventually that insensible gradations may exist from one to the other, yet at the present, for the purpose of con-

venience, we may formulate the following points of distinction:

By the term pseudoleukemia (Hodgkin's disease, malignant lymphoma) is denoted a condition characterized clinically by progressive enlargement of the various organs of the body in which lymphadenoid tissue occurs, extending by the way of the lymph channels from one group of glands or nodes to those in contiguity, and exhibiting histologically a proliferation of the reticulum and marked increase of fibrous tissue, associated with numerous lymphocytes. By sarcoma of lymphadenoid tissue (synonym, lymphosarcoma) is denoted a malignant enlargement of such tissue, exhibiting clinically a tendency to invade the organs in the immediate vicinity, and characterized histologically by a replacement of the normal follicular structure by numerous round cells with a small amount of endothelial reticulum.

REFERENCES.

Mamlok. A Case of Primary Malignant Lymphoma of the Tonsil. Fraenkel's Archiv. f. Laryngologie, Bd. 9, 485, 1899.

C. C. Simmons. Hodgkin's Disease. Journal of Medical Research, June, 1903, p. 378.

MALIGNANT DISEASE OF THE TONGUE, WITH A REPORT OF TWO CASES.*

By Joseph H. Bryan, M. D.,

WASHINGTON.

It is apparent to everyone that malignant affections of the tongue and upper air passages are on the increase, and I believe that it is only by the careful study of these affections both from the clinical side as well as from the pathologic standpoint, we can ever hope to gain any definite knowledge regarding this at present much unknown subject. In the majority of instances, it is the throat surgeon to whom these unfortunate patients first appeal for relief, and upon him devolves the responsibility of making an early diagnosis and of insisting upon an early operation in order to bring these cases to a successful issue. It is, therefore, very desirable that whenever the opportunity offers there be a free interchange of our experiences, and with that end in view I have to report two interesting cases that have recently come under my observation.

Case I. Last summer, while in Paris, I was consulted by a friend of mine, a man about 60 years of age, for what he considered an obstinate ulcer of the tongue. I knew him to be a man of abstemious habits, both as regards smoking and drinking.

On examination I found an indurated ulcer about the size of a ten-cent piece on the right border of the tongue, about its posterior third. It had an irritated appearance, caused by the use of strong applications of nitrate of silver and an iodin gargle, which he had been using on the advice of the several physicians he had previously consulted. There was a general sense of discomfort and occasionally pain at the seat of the ulcer. No enlargement of the glands on either side of the neck was observed. All local applications were positively

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*Read at 28th annual meeting of the American Laryngological Association, held at Niagara Falls, May 31, 1906.

prohibited, and he was referred to Mr. Butlin, whom he saw within ten days, who confirmed my diagnosis of a malignant growth of the tongue, and urged an immediate operation. This was about the latter part of August. I reached London in time to be present at the operation, which was done September 1st. A preliminary laryngotomy having been done, the whole right half of the tongue and a portion of the floor of the mouth was excised by means of the scissors, a gauze wick was placed in the back of the tongue near the floor, while the edges of the anterior half were brought together with cat-gut sutures. The patient made a rapid convalescence, being able to be about his room within ten days.

About three weeks from the date of the original operation, Mr. Butlin made a complete dissection of the right side of the neck, removing all the glands that could be found. From this operation the convalescence was also quick and favorable, and he was able to return to this country about the latter part of October.

The pathologic report from the Imperial Cancer Research Committee states that nothing looking like cancer was apparent either to the naked eye or to the microscope in the glands; but that in regard to the tumor removed from the tongue, was extremely unsatisfactory; it states the growth is a well developed squamous cell carcinoma which infiltrates very widely, isolated groups of epithelial cells being found in the deepest parts of the thin slice from the center of the growth.

From the time of his arrival in this country until January 1st, he was under the careful observation of Dr. Collins Warren of Boston, after which date he returned to Washington and came under my care. I made three examinations, a month apart, and found him in a most satisfactory condition. There was not the slightest evidence of any return of cancer in the mouth, and while not expecting any trouble on the left side of the neck, I carefully searched for enlarged glands on that side as well as on the affected side. March 13th, two weeks after the last examination, he reported at my office, stating he had discovered a small swelling in the left side of the neck. The examination revealed a small glandular enlargement about the size of an almond, located about the bifurcation of the common carotid. There was no tenderness and no other enlarged glands could be detected. He then

stated he had an imperative business appointment in Florida, which he desired to keep. I at first advised against his going, but finally yileded, with the understanding that he should return immediately if he found there was an increase in the swelling. Instead of being absent two weeks, as he expected, he returned within five days. The glands in the neck had enlarged very rapidly, a large painful mass could easily be felt over the carotid artery, the tongue was heavily coated and he had intense pains extending over the left side of the face and head and down into the left arm.

Dr. Finney was called in to see him, and it was decided to operate, which he did March 28th. As soon as the neck was opened his condition was found to be much more grave than we anticipated, a large cancerous mass was found in the deeper parts of the neck well under the steno-cleido mastoid muscle, and so firmly attached to the internal jugular and the common carotid that the coats of these vessels contained cancerous tissue which it was impossible to remove. It therefore became necessary to ligate and excise an inch or more of both vessels. The submental and maxillary glands were slightly enlarged, and they were also removed. The wound was then closed, except for the lower third of its extent, in which was placed a gauze wick for drainage. On opening the excised portion of the carotid artery, the vessel was found to be in the most advanced stage of atheromatous degeneration, and attached to one of the atheromatous plates was a large and firm thrombus. The duration of the operation was about two hours and the anesthesia used was ether.

The patient rallied well from the anesthetic and passed a fairly comfortable night, but about 8 o'clock the following morning he developed a complete hemiplegia. At 3 o'clock the same afternoon pneumonia in the left lung set in, and he died at 4 o'clock on the following afternoon, just forty-eight hours after the operation.

Case II. This case was in a man 70 years of age, unusually vigorous for a man of his age. I had been seeing him frequently for the past year or more for an obstinate dysphagia, without being able to find a cause for it. I saw him for the last time about the latter part of April, 1905, prior to his leaving town for the summer. Nothing abnormal about his larynx or fauces could be detected then. October 1st he came to see me for the customary examination, and I found

at the base of the tongue a large mass projecting out of the larynx up to the level of the tongue, and having the appearance of an exaggerated degree of edema of the epiglottis. There was no pain in the region of the larynx nor any difficulty in swallowing. In fact, the patient was not conscious of anything wrong with his throat. The growth bled easily on manipulation. Examination of the neck showed a small glandular enlargement about the bifurcation of the common carotid artery on the left side; a small portion of the growth was excised and sent to Dr. Carroll, the pathologist of the Army Medical Museum, for examination. The following is his report:

"An examination shows that the condition is one of surface epithelioma without the formulation of pearls. The dipping downward of the growth from the surface epithelium can be clearly traced. The location appears to be at the junction of the tongue and epiglottis, and the transition from stratified squamous epithelium to minute papillae is distinctly shown. No muscle fibres are found, and the underlying tissue consists of lymph nodes and alveolar tissue rich in lymphoid cells and lymph vessels."

An operation was decided imperative, and Dr. Finney was asked to take charge of the surgical side of the case. October 17th, the patient being under anesthesia, Dr. Finney did the Kocher operation. As soon as the tongue was drawn through the opening in the mylohyoid muscle, the floor of the mouth and the upper part of the larynx were brought well into view. It was then discovered that the growth sprang from the base of the tongue, and the epiglottis was not at all involved, as we were led to believe by the laryngoscopic appearances. The epiglottis was, however, curled upon itself from the pressure of the growth. The left half of the tongue was removed and a portion of the base of the right half. The submaxillary and sublingual and several enlarged cervical glands were also removed through an incision carried some distance down to the neck. The wound was then partially closed and a gauze wick passed from the mouth through the opening in the most depending portion of the wound in the neck.

The patient made a slow but uninterrupted recovery, the wound taking about six weeks before it completely closed. He was very much annoyed during this period by fluids and

food passing from the mouth through the wound, necessitating frequent changes of the dressings. The sinus finally closed, but there was left a thick and indurated condition of the neck over the site of the sinus.

The articulation in this case was very much disturbed in the beginning, but of late has been gradually improving. Another annoying symptom, and one that continues to trouble him very much, is the constant accumulation of mucus in the mouth.

In the early part of April the swelling in the neck became very red and painful and finally broke down, discharging some pus. At first it seemed as though this was a secondary infection of the skin, but under the use of the X-rays the parts thoroughly healed again, and all the thickening and induration have been absorbed, and at present, nearly eight months since the operation, there is no indication of any recurrence.

These two cases are both interesting and instructive, and show the decided importance of an early recognition of this dreaded disease. Jacobson and Steward in their work on " The Operations of Surgery," state that it will be a happy day when the belief is accepted and acted on, that cancer of the tongue, like many other epitheliomata, has a precancerous stage, and this is the stage when we should operate. **The terrible malignancy of cancer of the tongue is shown by** its rapid development which is aided by the warmth and **moisture of the mouth, and by the constant irritation it is** subjected to, and also by the almost certain and early invasion of the glands of the neck.

Case I is an unfortunate example in the delay of recognizing the disease, and shows several features, especially the **ab-sence** of infection of the glands of the neck on the affected side, and the sudden outburst in the glands on the opposite side of the neck. Mr. Butlin, in speaking of the case, says **it evidently was hopeless from the beginning, but we should** not take a desponding view of the treatment of epithelioma **of the tongue; it was an exceptional case and an earlier** operation might have had a more successful result. He also states that affection of the glands on the opposite side **of the neck, when the disease is actually on the border of** the tongue, as it was in this case, is a very unusual occurrence, although he has met with it two or three times. He is

not prepared at present to advocate the removal of the glands on both sides of the neck in every case of cancer of the tongue; but, on the other hand, he does not venture to declare that it may not become a routine treatment at some future date, when we have more information regarding the proportion of cases in which glandular affection of the opposite side is likely to occur.

Case II was also of a highly malignant type and showed an unusually rapid development. Of course, it is too soon to say what the final outcome of this case will be.

LXXI.

TREATMENT AFTER THE RADICAL OPERATION FOR CHRONIC SUPPURATIVE FRONTAL ANTRITIS.*

By Dr. H. Luc,

PARIS.

Innumerable methods of operation for the radical cure of chronic suppuration in the accessory cavities of the nasal fossae, especially the maxillary and frontal sinuses, have had their day in recent years. It is only fair to note that a goodly number of these pretended new methods were characterized by insignificant modifications of former methods. One single thought seems to have inspired the majority of their authors, that of establishing as large a communication as possible between the nasal cavity and the suppurating focus, after freely opening and carefully disinfecting the latter.

It is generally agreed nowadays that so far as the frontal sinus is concerned, this central idea has been ideally realized by the method of Killian, by resection of the ascending branch of the maxilla and creating directly in front of the ethmoidal labyrinth a large opening which permits deep destruction of the latter, and enlargement of the fronto-nasal communication which is generally insufficient, under normal conditions, for good post-operative drainage of a frontal sinus, no matter how small.

Killian has given a clear description of his method, which has been reproduced in most of the rhinologic journals, and which it has been possible for the majority of us to practice successfully upon the living after trial upon the cadaver. On the other hand, I believe I speak for a number of my colleagues in noting the hiatus relative to the post-operative care demanded by the operation. In this respect, those of my colleagues who, like myself, have done Killian's operation according to description, have been driven to groping, correcting from one operation to another the imperfections

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*Translated by Albert Miller, A. B., M. D., St. Louis.

of their technic. I believe, then, that I am doing useful work in setting forth the rules of procedure which I have acquired from a personal experience of twenty cases.

I will suppose that the operation done has been that of Killian (which I consider really the best and most likely to avoid post-operative accidents). I will suppose furthermore, that the operative breach has .been proportionate in its extent to that of the frontal sinus, of such a sort that none of its ramifications have escaped curettage and disinfection, and that by complete resection of the ethmoid cells a communication as large as possible has been established between the frontal focus and the nasal fossa. Also, that not only has the resection of the anterior wall been carried to the extreme superior and external limits of the bony cavity, but that care has been taken to avoid the subsequent existence of any angle of bone which may produce ulceration by pressure upon the skin carefully applied to the deep osseous cavity.

With these precautions the patient has every chance of a prompt cure, that is to say, in three or four weeks, if his frontal sinus does not conceal any prolongation which has escaped opening and cleaning, and if no ulterior fault has been committed.

Before entering upon the question of post-operative care, other matters present themselves: Is it wise to tampon and keep the sinus tamponed for one or several days with absorbent gauze, either iodoformized or not? May we or should we immediately and completely suture the cutaneous wound? As for the first question, I admit having adopted up to the last two years the practice of tamponing the sinus with iodoform gauze, introduced, before suture of the wound, into all the ramifications of the sinus, while the other end was carried through the large nasal communication to the nasal entrance. Since then, being desirous of simplifying an operation so long and complex in its other steps, I have stopped this technical detail without regret, preferring at the end of the operation to apply the skin deeply to the bony walls above the orbital arch which has been conserved. It appears to me that real benefit to the patient has resulted from this simplification, and he is thus spared the pain of extracting the drain and the inconvenience of its presence in the nasal fossa.

More delicate to trench upon is the question of immediately uniting the cutaneous wound. For my part, I have always

done it, except in one patient in whom the very extraordinary dimensions of the frontal antrum had favored a recurrence from retention, an accident which I had tried to avoid at my second operation by keeping the external wound open for several days by a large drain. After the visit which I made that same year to Professor Killian's clinic, and after a conversation with him concerning a case of frontal antritis complicated with infection of the soft parts which he operated upon in my presence, I was rather disposed to imitate his example in similar cases, that is to say, not to suture until after twenty-four or forty-eight hours, during which the cavity was kept packed with gauze. I imagine that in such cases a moist dressing would be better for disinfection. Killian thinks that this precaution is the best means of avoiding post-operative erysipelas. In fact, I recall two cases of erysipelas terminating fatally which were naturally explained by the fact that immediate suture had been done upon the infected skin as was shown by edema and redness. Aside from this, it appears to me very advantageous for the patient that, the moment disinfection is complete and free communication with the nasal fossa is created, the wound should be immediately united.

Suture having been done, the indications for treatment are limited to three, as follows: (1) To take the rectal temperature for three weeks, morning and evening, in order to avert right at the beginning the slightest symptom of retention. (2) To preserve perfect communication between the sinus and the nasal fossa. (3) To promote the attachment of the skin to the deep bony walls.

In the great majority of cases when Killian's operation has been done according to the author's rules, there results such an enlargement of the fronto-nasal duct that we need hardly fear retention, which we see too often at the third week after the so-called Ogston-Luc method. Nevertheless, it is indisputable that the passage in question, however large it may appear after the operation, shows after a few days a marked tendency to contract. This circumstance, together with the peculiar character of the pathologic post-operative secretions in the nasal fossa, generally thick and tending to form crusts, explains how the latter may at any time block up the focus and be an obstacle to the escape of pus. So I have adopted the practice, no matter how few the crusts

may be, of extracting them from the nasal fossa each day
by means of a special long forceps. Then with a cotton
carrier with a curved end, the concavity being directed above
and forward, and the swab impregnated with hydrogen
dioxid, or an iodized solution, I sweep it without violence
through the fronto-nasal tract which is generally easy to dis-
tinguish. In this manner its permeability is absolutely as-
sured. On the other hand, I disapprove of every sort of
lavage which might result in infecting the newly sutured skin
wound. I advise the patient, also, not to blow his nose ex-
cept with moderate effort, in order to avoid distension and
infiltration with air of the soft parts which are not yet firmly
united over the breach. Finally, it has seemed to me use-
ful, as soon as the crusts begin to form in the nasal fossa,
to have the patient use a mentholated spray several times daily
to soften the pathologic accumulations and aid their expulsion.

However small the frontal antrum may be, requiring a cor-
responding resection of its anterior wall, it is usual, if the
operation is successful, for a slight depression to appear over
the wound between the second and fourth week. This de-
pression becomes more accentuated subsequently as the path-
ologic secretions diminish and the scar tissue develops which
tends to unite the skin with the depths of the bony cavity.
My experience has taught me to consider this depression as
an excellent sign of cure. Although its formation is often
the spontaneous result of cicatrization, as I have just said,
I believe it is advantageous to favor its appearance, to fish
for it so to speak, by exerting slight compression beginning
with the first dressing, over the opening, by means of gauze
pledgets piled upon each other and corresponding as nearly
as possible to the size of the breach. Care should be taken
in applying the elastic bandage to make the turns from above
downward so as to force the contents into the nasal fossa
and not shut them up inside. Besides, the pressure of the
bandage should be very moderate, especially if the bone bor-
ders have not been carefully smoothed. In fact, I have had
occasion to observe several times in these conditions the ap-
pearance of phlyctenules followed by ulceration of the skin
and evidently due to compression against the borders men-
tioned, perhaps also favored by section of the cutaneous fila-
ments of the frontal nerve thus predisposing the area to
trophic troubles. I have adopted the practice of keep-

ing on the compressive bandage for a month after operation, both to protect the region from trauma and to avoid the risk of distension of the sinus with air from intemperate efforts to blow the nose. I am also careful to renew it often, in order to watch the progress of skin attachment and to avoid the above mentioned inconveniences of exaggerated pressure.

In the great majority of cases, when the operation has been well done, that is to say, when it has fulfilled the double indication of completely disinfecting the fronto-ethmoidal focus and creating a free fronto-nasal channel, and the subsequent maintenance of this channel, complete cure is attained in about one month. Thereafter, the frontal bandage becomes useless, and the patient requires less and less care.

LXXII.

HOW FAR ARE ABNORMALITIES OF THE NASAL SEPTUM RESPONSIBLE FOR MAL-FUNCTION OF THE NOSE?

By Henry L. Swain, M. D.,

PROFESSOR OF LARYNGOLOGY AND OTOLOGY IN YALE UNIVERSITY.

NEW HAVEN.

It is well-nigh axiomatic, an aphorism, that if a person received the divine heritage of an anatomically and physiologically perfect nose and always lived a perfectly ordered life ever after, he, or more presumably she, would never suffer from catarrh, using the word as a generic term for nasal disease. With a perfect and perfectly functioning nose very little or no throat disease would exist, unless of tonsillar (lymphoid) origin or arising from systemic conditions. Assuming that germs existed coeval with man's origin, if not before, man is a mere incident to their career. They are parasites; man, the host or domicile. In ages past certain races of men may have been worn out for the use of some kinds of germs, so these last underwent certain changes which enabled them to still do business with the genus *Homo sapiens*. Of these acquired characteristics, some remained and, by the aid of these, various races of germs have been perpetuated, so that we now have big and little, ærobic and anærobic, capsulated and plain, crooked and straight, intercellular and free, cocci and bacilli. The cells of man have no sooner learned to repel one of the kinds than a new horde with different habits and desires swoop down upon them, and new protections must be erected, new defences established.

Inasmuch as it would be obviously a poor plan for either man or animal to always rely upon the ability of the cells to cope with the germs and thus repel disease, gross methods of protection have always existed and are first used, and it is only on the failure of these that work is demanded of the cells themselves. Sneezing is perhaps the first method which is in use among animals to protect them against foreign mat-

ter which has entered the nostril, and from their sensitive
mucous membranes the slightest irritant is immediately ex-
pedited, and sneeze follows sneeze until removal is accom-
plished.   When exercising or otherwise more liable to get
floating matter into the nose, the dog, for example, breathes
through the mouth, so that nothing may interfere with the
important function of scent.   In man and most animals, the
sneeze is followed by a flow of fluid, usually free from mucus,
which in man represents not always a secretion from the
glands in the nose, but rather a transudation through the cell
interspaces in addition to the flow from the lachrymal glands.
Man helps the cleansing or removal by voluntary act of blow-
ing the nose or snuffing back into the throat, followed by
hawking.   By these gross means, gross or macroscopic irri-
tations when present are removed.   Smaller or microscopic
particles which are floating in the air are first held up by
the small hairs which grow more or less profusely at the en-
tance of the nose.   These, especially when moist, must act
as an effective sieve.   Whether there is anything providen-
tial in the fact that the older one grows the more abundant
these hairs appear to be, is a matter for conjecture.   Beyond
the openings the mechanism of the perfect nose is admira-
ble; divided by a septum in two equal parts, each with its
subdivisions of the space into convoluted tubes or fossae,
bringing a large surface upon which to deposit the floating
particles as well as a greater radiating equivalent in carry-
ing out the physiologic functions of warming and moisten-
ing the air.   This subdivision into two equal sides and these
again into tubes or gutters is essential also for good cleans-
ing by blowing, as we often learn to our sorrow in atrophic
and diseased or deformed conditions.   The general trend of
the passages is downwards as well as backwards when the
head is erect, hence exuded fluid, as from irritation, tends
of itself to wash the foreign matter down and out of the
nose—to the front largely by blowing, to the rear by gravity.
All this is aided by the ciliated epithelium in certain parts,
the ciliae working in a general way backwards and down-
wards, helping very much, in my judgment, in preventing
that prolonged sojourn of finely divided matter, whether
active or not, which results deleteriously to the exposed parts.
A further aid comes when by the swelling due to the erectile
tissue the tubular passages become smaller, making the cleans-

ing, when continuity is uninterrupted, from any given effort easy. The passage of a large quantity of air through a smaller tube gives greater frictional (cleansing) possibilities than when the same amount of air with equal velocity traverses a larger space. So it transpires that the gross anatomic arrangement serves well to stop within the nose floating bodies, and the parts most liable to thus bear the burden and heat of the day are the anterior end of the middle turbinate and the inferior to a lesser degree. These project from the side of the nose where the currents of air must swirl past them with many an eddy as they stand boldly forth to stem the tide.

Now, allow that on the wings of a mighty inspiration floating matter has been wafted through the nose. The particles in the middle of the stream surge along until the current turns downward toward the larynx. Those with the greatest centrifugal inertia are thrown directly upon the posterior pharyngeal wall. Covering this whole posterior surface, where there is little or no ciliated epithelium, there is a protective layer of mucous secretion which immediately enmeshes anything which lands upon it. Gravity and fresh secretion soon expedite such detained matter downwards and out. So all kinds of dust must run the gauntlet ere they get into the larynx and trachea, and, although much gets through safely without let or hindrance, still the protective apparatus does lessen the danger by the peculiar construction of the parts.

But how about the microscopic particles, the subtle germ whose entrance is not heralded by any such cataclysm as the violent sneeze? The entrance may take place in the dead of night, and only the ever watchful epithelial or endothelial cell by chemotactic sense or electric thrill learns that the invader is at hand.

When the sentinel gives the alarm immediately the leucocyte, with phagocytic appetite, sallies through the portals, and with his exit from vessel and tissue more of his kind are hurried to the front, more blood comes to the vessels, they passively stretch, capillary congestion and venous stasis allow the passage of the white cells and serum into the tissue, the whole membrane swells, mucous glands pour forth abundant mucus, contacts are established between adjacent areas, sneezing again results, either from mere contact or

from fluids running down between surfaces not absolutely touching, and the fight is on.

This considers merely the nasal mucosa, not the tonsils. Here the process is so different that another figure must be used. That we do not oftener have nasal invasions comes from the mechanical action of the normal ciliated epithelium. The removal is aided by the fact that serous fluids constantly present on the surfaces have a deterrent effect on germ growth if not actual germicidal action. Life is not easy for the germ, and unless it is midway in the stream of air and strikes no hindrance on its way to the trachea, the convoluted surface of the nose catches it, usually to its death.

Whether as in adults, upon the broad arched roof, or as in children, on the shallower and more sloping vault, if the germ is caught upon the posterior pharyngeal wall, it meets lymphoid tissue, and here lies the most active of the repellent forces of the upper air passages. Immediately beneath the epithelial layer, which is of the flatter, squamous type, and even between the cells themselves, lie thousands of potential leucocytes capable of amebic motion, and although the lymphoid tissue really is but a modified lymph node, still within its outer walls of epithelium lie a vast army of rapacious phagocytes which rise in wrath and indignation to combat with the invading hosts. So here again the unlucky germs when, by their very speed, they are carried past the outworks of the nose find defenders present and usually perish.

Thus it is reasoned that the anatomic arrangement of the nose is such that, by the free flowing of mucus, the motion of the ciliated cells, and the general trend downwards and backwards of the passage allowing the protecting fluids more easily to accomplish their cleansing, it actually tends to remove all inorganic and insoluble matter and to thwart the prolonged resting of the living and active substances. The chemical or phagocytic destruction of living organisms falls upon the cells by the failure of removal by these previously mentioned means.

Several ways exist naturally to render the protective system useless. First, the grosser methods are rendered impossible by deformities of the skeleton of the nose, rendering ready cleansing by sneezing and blowing and the free downward flow of fluids practically impossible. Here is a chance of which the invaders readily avail themselves. Skulking

back of a large exostosis, they evoke secretions which remain in situ, producing a splendid breeding ground for the germs, warm, snug and nutritious, and hundreds, yes thousands, are bred where one attacked at the beginning, and their very numbers overcome the cell defenders in that little area, resulting in an acute rhinitis.   Mayhap an artificial cleanser might have removed the intruders, but natural methods failed because of unnatural conditions.   The cells were all healthy perhaps, but the odds against them in a limited area were too great.

The protective organization depends again on the itegrity of the outer wall, the eplithelial layer.   Suppose through injury some considerable area of ciliated epithelium is dead, or through great debility or perhaps through prolonged exposure to great cold, chemical irritation or dry heat, the actual activity of all the ciliated epithelium in the nose should be reduced to the minimum, or even inhibited for a time.   Then how easily could the hardy germ work in past the outer wall "while yet they slept who should protect."   Under such conditions, or those of profound systemic depression, the activity of not only the ciliated epithelium but also the appetites of the usually voracious phagocytes might be reduced so that again the germ might get in beyond the outworks.   Such or other conditions of the system might produce a different serum, might modify the amount of fluid actually running into the nose, or might add more or altered mucus in which germs would actually thrive.   These are but a few of the suggestions which rush to one's mind whereby the outworks and defences of the nasal tract may, so to speak, be rushed and stormed, and thus the disease become systemic because the germ has lived to perpetuate its kind owing to lack of or imperfect cell-guard.

We have considered macroscopic and microscopic forms of invasion and the means of protection against them.   What shall we say at this juncture of the yet subtler irritations, chemical, electric, we know not what, which are only apparent to the hyperesthetic cells of the susceptible, when they react to the immeasurably small particles proceeding from hay or flowers, from the horse or from the cat, or from a special brand of feathers, or even the odor of perfume, as musk? How intangible is such an emanation; as easy to grasp as an atom, as easy to see as an ion, as easy to understand as the

mysteries of Providence, unless, forsooth, you are cursed with the responsive cells, and then all is so different. How excruciating the irritation, how obvious the tears, how abject the victim, until he feels sure that he represents the torments of the evil one. These, by all other means imperceptible forces, make themselves as evident to the victim as to another would be a dose of red pepper in the nostrils, and it seems to me the conditions are absolutely parallel. What an explosion of all the repellent forces we have considered takes place in both instances—sneezing, blowing, floods of serum and tears, even of mucus; what redness is evoked, what stoppage in the nostrils, all to rid the membrane of the irritant. The protective system is again trying to do its allotted work, and yet how infinitesimal the particle, how attenuated the influence, how it must be reduced to the utmost refinement of chemotaxis in order correctly to estimate what it means. If the unsusceptible are, on the one hand, so irresponsive, and the susceptible so abjectly enthralled, must there not be great differences in the characteristics of the cells themselves? And if of these in the nose, may there not be also similar differences in many other cells of the body? Is it not analogous—but equally mysterious—to the differences which must exist in the cells of the gray matter of a Huxley or a Kelvin as compared with those of an imbecile or an idiot? Nor does this problem present one whit greater difficulties than to understand how the nerve endings in the dog's nose discover to him his master's footsteps among those of a multitude, or lead the unerring bloodhound straight to his victim. Ponder as we may on these wondrous powers, another problem confronts us of equal difficulty. Solve it, and you have the key to all physiologic phenomena—yes, the keys of life and death are in your hand. How do the ever watchful epithelial or phagocytic white cells know that disease germs are present—distinguishing as they apparently do between inert matter which they allow to pass, harmless living matter which they allow to remain, and pathogenic germs which they endeavor to destroy? By what alchemy is the whole system aroused as the grippe germ begins work in our bodies? By what charm does the meningococcus reduce the guard at the front, pass in, and, having massed his army within the gates, in a moment, the twinkling of an eye, the victim lapses into unconsciousness, perhaps never to awaken? And yet our

daily walk and perpetuity depend upon the vigilance, dis-
cretion and discrimination of a few cells. How little then
must it take to disturb the happy equilibrium of decay and
restitution which we call health; how little to knock out our
protective system. And yet this is only the beginning of the
problem.

From repeated acute attacks of rhinitis come chronic
catarrhs. The existence of chronic catarrhs makes us sus-
ceptible to renewed acute attacks, and so the endless chain
of cause and effect and effect becoming cause brings about
chronic inflammation within the nose. The mere hyperplasia
of repeated attacks of acute rhinitis is succeeded by hyper-
trophy, leads on the one hand to atrophy and on the other
to edematous conditions and polyps, and both lead in the end
to bone changes. Then we have the gross effects seen in
the operating room of the surgeon and in the deadhouse.

In all these cases something defeated the plan of nature
and the nose has ceased to be a perfect and perfectly func-
tioning organ; in fact, it has become, instead of a safeguard,
a menace to the health. Instead of cleansing and freeing it-
self of germs, it harbors them. Instead of secreting a fluid
detrimental to germs, it serves up a most nutritious pabulum
for their use. Instead of breathing pure air in open pro-
test to sedition, it closes a nostril, and, granting to certain
applicants the seclusion of private apartments, an antrum or
a frontal sinus cultivates as pure and virulent a culture of
a select breed of coccus as ever graced a laboratory incubator.
Surely something has happened to disturb the order of nature,
and it has been the habit of the rhinologist, either by open
assertion or tacitly because of his unvarying practice, to lay
the burden of all of this pathological change and disturbance
of function when of a chronic nature to the septum, the err-
ing brother upon whose shoulders as upon a scapegoat is igno-
miniously loaded all the blame for all that has happened. And
never has a defender arisen for the poor helpless victim. Con-
demned without a hearing, and if but to a decent death, how
differently might we review the past! The utmost refine-
ment of savage butchery pales into sordid insignificance when
the detailed sufferings of the nasal septum are spread be-
fore us.

Notwithstanding, however, the most unprecedented activity
on the part of the profession, during the last twenty-five

years, there have lived and died at a ripe old age in every community a few unmutilated persons. These have passed to the great beyond from reasons incident to senility or from accident or from disease of other parts of the body, having never suffered from impairment of hearing other than presbyakousis or any other so-called catarrhal difficulty which caused them to become the legitimate prey of the specialist, and yet they have harbored from their earliest infancy more or less crooked septa which they inherited as a result of facial asymmetry, these irregularities exaggerated by the accidents of disease, neglect of teeth and trauma in youth, so that they have possessed through years as grossly misshapen septa as it has ever been our fortune to hack and hew into the semblance of orthodox uprightness. And when we think, on the other hand, how rarely there ever is a straight septum, should we not be made to wonder, if our premises are correct, why anyone ever escapes with two good ears and a healthy pharynx?

And while we are on the point, have we not all got the septum habit, the habit of doing something to the septum so much as a routine that we feel that we have almost been derelict in our duty by the patient who applies for treatment of his nasal catarrh if we have not vigorously attacked the dividing wall of his nose? What has been the method of reasoning? Are we correctly understood when we are accredited with believing that the deviations of the septum from the straight and perpendicular are of such immense importance? We as members of this association and in our work as clinicians and teachers in medical colleges have certainly given the impression that the origin of the pathologic conditions known as chronic catarrh is to be traced in man to the disturbance of the function of the nose which results when the septum bends to either one side or the other, causing narrowing, pressure and lack of proper aeration. It has been usually reasoned that an exostosis, for example, which projects from the septum far over toward the lateral wall, must interfere with the function of the nose in three or four ways. First, the air could not with proper freedom pass through the nose; the whole stream of air must be turned one way or the other or divided by it. Second, it interferes with cleansing the nose by blowing. Third, it presses upon the mucous membrane of the turbinates when

these swell, as in the ordinary physiologic ebb and flow of the blood in the nostrils or when irritated or inflamed. This constant condition of greater or less pressure interferes with the proper circuation in the membrane. It interferes with the cleansing. It interferes with the work of the protective system. It affords a chance for the retention of discharge. This discharge when retained may become fetid and irritating, may destroy ciliated epithelium by drying or by the virulence of the germs which are in culture in the fluid secretion. The dictum goes forth: as it can bear nothing but ill fruit, "Cut it down, why cumbereth it the septum?" Certainly with this view our attitude seems, in the light of the present-day conception, perfectly rational, perfectly proper. In a marked instance of this description as in a marked instance where the septum is bent so as to actually interfere with breathing, there can be no argument against ridding the host of such abnormalities and the difficulties resulting therefrom. It remains therefore, if these premises are accepted as correct, to accomplish this by as mild measures, with as little destruction of normal epithelium, and with as good preservation of the normal anatomical construction of the parts as possible.

I certainly cannot make it seem right to remove turbinate tissue when it is an exostosis of the septum which is at fault. It may be easier, but it is not logical. Neither can I make it seem right to remove turbinal tissue when what is needed is to make a crooked septum straighter. Especially to-day, when submucous resection in conservative hands seems so successful, there is no good reason for halting in one's duty.

And yet, when we come to look back over twenty or twenty-five years of work, to follow up the cases wherein we have done all these things by what at the time seemed to be the best method, has the catarrh that we seemed at first to relieve always remained permanently benefited? When we have done our best sometimes to straighten a septem and remove a spur, have we not merely improved conditions and not completely relieved, and are we not compelled many times after our utmost endeavors to cure great deformities to leave the patient's septum in a condition in which he is no better off than another unoperated patient who comes with a most atrocious catarrh? Do we not fall into the habit of laying the whole catarrh to this slight bend, which is no worse than

the best result we could obtain in the other case, and have
we not operated many times on these lesser curves, follow-
ing out the idea almost from force of habit? And then do
we not, if we see these patients years afterwards, find that
they again have the hypertrophies, again have the frequent
colds, again have the catarrhal dropping? Perhaps the polyps
have returned and mayhap the sinusitis. We have in each
of these instances gone to the full extent of what was need-
ed in reforming the septum, and yet, in spite of these radical
measures, again the catarrh recurs.

This must mean, then, that it requires something more than
the bent septum to produce catarrh, and the question naturally
arises: Is it not in the life that we of the present day are
compelled to lead? The dust, confined, narrow apartments,
the dry heat, the late hours, the busy work, all contribute to
a condition of nose and body which causes a catarrh to re-
turn which, while the patient was directly under our care,
certainly improved. These latter thoughts have been forced
upon me in the last few years as, looking back over a con-
siderable period of active work, I have been forced to be-
lieve that the septum alone is not responsible for all that we
have placed upon it.

Since beginning the series of papers which I have presented
to the Association in the last few years, when the relation of
the arch of the palate to the septum was studied, I have made
it the invariable rule with every patient who came in to ex-
amine the septum and to find out the amount of catarrhal dif-
ficulty existing, questioning the patients who came to me about
other matters, not conscious of any catarrh, inquiring as to
the amount of catarrh present at the time the patient came as
compared with the years and years during which he must have
had a crooked septum. I find that it is certainly possible for
crooked septa to exist in healthy individuals who lead well-
ordered lives without ever producing noticeable catarrh. Sec-
ondly, that we can bring the septum into subjection, straighten
it, plane it down, smooth it off, and still colds and frequently
repeated annual catarrhs continue, while sinusitis is brought
about in spite of it all. Unless the life of the patient is changed
in some way or his constitutional conditions modified, hyper-
trophy will again return, and it seems to me that we have fallen
far short of our duty by our patient if we simply correct the
errors of the septum and cauterize the turbinates. Ought we

not then, as we present various ideas to the public, to right the impression which has gone abroad, thanks to our own faulty presentation it may be, that a rhinologist when he is not opening a sinus is merely the carpenter of the septum?

Certainly, having in mind the protective apparatus alone, we should bestir ourselves, take into our confidence if necessary the family physician, investigate into the life the patient is leading, into the finer details of every-day occurrences, to search out a method that shall have the wider, broader possibilities of therapy in mind rather than to confine ourselves so strictly within the narrow quarters of the nose and limit our endeavors to such stunted conceptions.

LXXIII.

SKIAGRAPHY IN THE DIAGNOSIS OF FRONTAL SINUSITIS.

By W. A. Chisholm, M. D.,

NEW YORK.

At the meeting of the Eastern Section of the American Laryngological, Rhinological and Otological Society, February, 1905, Dr. C. G. Coakley read a paper on the above mentioned subject. Basing his observations on forty-four skiagraphs which he had taken up to that time, he arrived at certain conclusions. One of these (the third) was as follows (ANNALS OF OTOLOGY, RHINOLOGY AND LARYNGOLOGY, March, 1905):

"In all cases of unilateral disease of the frontal sinus, verified by operation, we have observed a cloudiness in part or all of the area occupied by the sinus, and an indistinctness in the outline of the cavity when compared with the opposite or healthy side."

In its account of a discussion on the same subject at the Annual Meeting of the Association in June, 1905, the October number of the *Laryngoscope,* page 810, reports a distinguished member as expressing the following views:

"In regard to skiagraphy he said it was a very beautiful and instructive method of demonstrating the size of the frontal sinuses and their relation to one another, but he doubted the statement made by one of the speakers that it showed diseased conditions of the sinuses. He did not believe that the X-rays demonstrated the diseased sinuses in any way, shape or manner."

By the introduction of some skiagraphic prints later on, I shall endeavor to show that this is an erroneous opinion, which, I believe, could be arrived at only by studying an insufficient number of plates, or those that were inferior. In unilateral disease of the sinus, good plates show in varying degree, the characteristic differences specified in the first quoted paper.

The reason why the normal and diseased sinuses should present different appearances in the plate had not been defi-

nitely determined. Increased thickening of the mucous membrane, fluid contained in the cavity, changes in the bone, were all advanced as possible causes. The following experiments and deductions are the result of Dr. Coakley's suggestions to me that I try to determine the cause.

As I knew little or nothing about X-ray work, I applied to Dr. E. W. Caldwell, Director of the X-ray Laboratory at the University and Bellevue Hospital Medical College, for assistance. He kindly complied and to his skill I attribute any success that may have attended our efforts.

Mucous membrane was the subject of our first investigation. We desired to ascertain whether the shadow cast by a moist membrane differed from that of a membrane which had been previously dried. Two portions were taken from intestine, one of which was kept moist, the other spread on a thin board and carefully dried by means of an alcohol lamp. They were then X-rayed, side by side. Of the resulting skiagraphs Figs. I, II, III and IV are presented.

One end of each portion of the membrane was spread out flat, represented by (A), while the other end of each was folded on itself twice, thus giving three thicknesses at that part (B). This was done to aid comparison if the shadows were to prove very faint. In the prints the moist portion of one thickness (A) shows in Figs. 1 and 3 a deep shadow, markedly accentuated in the part folded upon itself (B). The dry portion, on the other hand, is scarcely visible in Figs. 2 and 4, in the section where there was one thickness (A), and the picture is not much more distinct in the part where there were three thicknesses (B). One can deduce from this that it is the moisture in the membrane that deepens the shadow.

Our next experiment consisted in determining whether pus or other fluid in a cavity cast a shadow in the radiograph different from that cast by a cavity filled with air. For this purpose empty gelatine capsules were selected. No. 1 was left empty, No. 2 filled with pus, No. 3 filled with saline solution and No. 4 filled with blood. Some difficulty was experienced on account of the softening of the capsules on introducing the fluids. As a consequence, the capsules containing pus (No. 2) and blood (No. 4) were not completely filled and a strip of adhesive had to be employed to retain them in position. Two

exposures were taken, the first lasting one second, Fig. 5, the other lasting two seconds, Fig. 6.

In the prints presented, Figs. 5 and 6, the capsules containing the pus, saline solution and blood, Numbers 2, 3 and 4 respectively, cast deep shadows of practically equal intensity, while the outline of the capsule filled with air (No. 1) is barely discernible. The wavy band along the lower half of the capsules represents the adhesive. The bubbles of air in the pus and blood (Nos. 2 and 4) show very distinctly. These air bubbles, obtained by accident, proved a very valuable aid to us, showing that cavities filled with air cast a much lighter shadow than those filled with fluid.

The next step was to fill an empty frontal sinus with pus or something equivalent to it, and observe the change effected in the plate. Saline solution was chosen as it could be more easily handled than pus. As the fluid could not be introduced through the fronto-nasal duct, an incision was made over the sinus, and the bone exposed. With a small trephine an opening was made into the sinus, the cavity was filled and the button of bone and soft tissues replaced. It was found, however, that although efforts were made to plug the fronto-nasal duct, the fluid leaked out before a satisfactory plate could be obtained. It was decided that it was a matter of some difficulty to get fluid to remain in the cavity. Some substance that could be introduced as fluid so as to fill all parts, then solidify so as not to escape was required. It was essential also that it should cast the same shadow as pus. Gelatine was suggested and it was determined to try it.

First it was necessary to find what it showed on being X-rayed. As the capsules in the other experiment did not answer the purpose perfectly, a new method of comparison was instituted. A piece of hard rubber, six inches long, one inch wide and one-half an inch thick was secured. Six holes, ⅝ of an inch in diameter, were bored through it. A thin strip of gutta-percha was laid on the bottom and fastened to it with bicycle cement; this would not interfere with the rays. There were thus six receptacles of the same size and shape. Into No. 1 two c.c.'s of gelatine which became firm directly was placed. Into No. 2, two c.c.'s of pus was dropped. Into No. 3, blood to the same amount was introduced. Into No. 4, saline solution and into No. 5, water was placed—the fluids in each case

being dropped from a measured pipette. No. 6 was left full
of air. An exposure of one-half second was made (Fig. 7)
followed by another lasting one second (Fig. 8).

The prints show in both figures the gelatine (1), pus (2),
blood (3), saline solution (4) and water (5) displaying well
marked shadows which appear to be identical in intensity, while
the sixth (air) is clear. Judging from the shadows cast on
these plates by the various substances, gelatine was equivalent
to pus in casting a shadow.

Another head was secured which had previously been kept
dry, so that no fluid would get into the sinuses. A radiograph
was taken in order to map out the frontals. An incision was
then made through the soft tissues beginning at a point a little
outside the external angular process, extending up to the hair
line, then horizontally and down to a corresponding point on
the other side. The periosteum was peeled down below the supra-orbital ridge. With the first plate as a guide, four holes ⅛
of an inch in diameter were drilled into the upper margins of
the sinuses so that in filling no air-bubbles would remain. The
cavities were found dry and membranes normal. The soft tissues were then replaced and a second plate taken (Fig. 9).

This showed the right sinus apparently completely divided
into two nearly equal parts by a bony septum and the left partially divided. The outlines were well defined, and the sinuses
appeared normal. The openings made by the drill were visible.
Gelatine was dissolved in hot water and cooled until it became
syrupy; a syringe holding a dram, with a needle ⅛ of an inch
in diameter so as to exactly fill the drill hole, was filled with the
thickening gelatine. It was then allowed to cool still further
until some little effort was required to expel its contents. The
left side was selected for the injection. It seemed very capacious, requiring four syringefuls to fill it. A good deal of
pressure was exerted in order to completely fill the same. The
soft tissues were again placed in position and a final plate
taken. The exposure was the same as in the other cases—
thirty seconds.

The print of this last skiagraph shows what looks to be the
whole left, and inner half of the right sinus, clouded and fogged with the outline very indistinct—an appearance identical
with that shown in a diseased sinus. What appears to be
the outer half of the right sinus up to the bony septum dis-

plays the appearance it previously presented. The real condition was disclosed by subsequent examination. The true septum dividing the sinuses was not in the median line, but was the one which appeared to be near the middle of the right sinus and showed complete in the first plate. Thus was produced a very large left sinus and a correspondingly small right one. An incomplete bony septum was found in the median line being defective in the lower end. No regret was felt that this condition existed as it rendered the picture all the more interesting.

For the sake of comparison I present prints of several skiagraphs showing diseased frontal sinuses. For these I am indebted to Dr. Coakley, who has kindly loaned them to me for this purpose.

Fig. 11 shows the right sinus clear and distinct, the left cloudy and indistinct. The print in this case does not represent the difference as clearly as the plate does. Operation revealed a sinus full of secretion but the mucous membrane was not perceptibly thickened. The trouble was largely obstructive, as the bottom of the fronto-nasal duct was so constricted that a small sized probe could not find an outlet into the nasal cavity. Here we have a nearly normal mucous membrane and a cavity filled with fluid. This agrees with the gelatine experiment.

Fig. 12 is very similar to the one shown of the sinus filled with gelatine. Here in the same way the left sinus extends far beyond the median line, rendering the right correspondingly small. The large left sinus shows hazy and dim in outline. Operation revealed greatly thickened membrane and pus in the left.

In this case transillumination and other evidences pointed to double frontal sinusitis. As complete confidence had not at that time been established in skiagraphy, an exploratory operation was performed on the left side. A dilatation of the infundibulum was revealed but no sinus in the vertical portion of the frontal bone, although exploration was thorough.

In conclusion: While no print can show the diseased condition as plainly as the original negative, these that have been presented distinctly show the difference between the normal and diseased sinuses, and I believe the value of the skiagraph as an aid in diagnosis of these conditions can scarcely be overestimated.

As a result of our experiments I think it may fairly be con-
cluded that the characteristic appearance of a diseased sinus is
due to the fluid contained, whether it be free in the sinus or
contained in the thickened, edematous membrane.

The necessity of good skiagraphs cannot be insisted upon
too strongly. A poor skiagraph may be sufficient to determine
the presence or absence of a sinus and possibly the number and
situation of the septa without being of any assistance in deter-
mining the presence or absence of disease.

As in other methods of diagnosis, the skilled observer notices
changes which would escape the observation of a less practiced
eye.
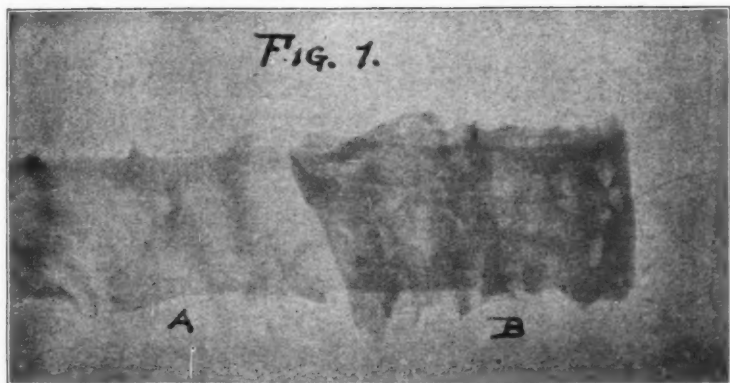
Fig. 1.—Skiagraph of moist intestinal mucous membrane.
A—One thickness. B—Three thicknesses. Time of exposure,
one second.
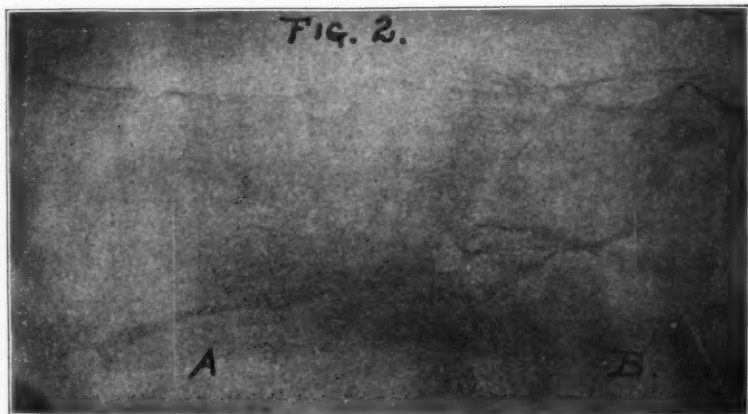
Fig. 2.—Skiagraph of dried intestinal mucous membrane.
A—One thicknesss. B—Three thicknesses. Time of exposure,
one second.
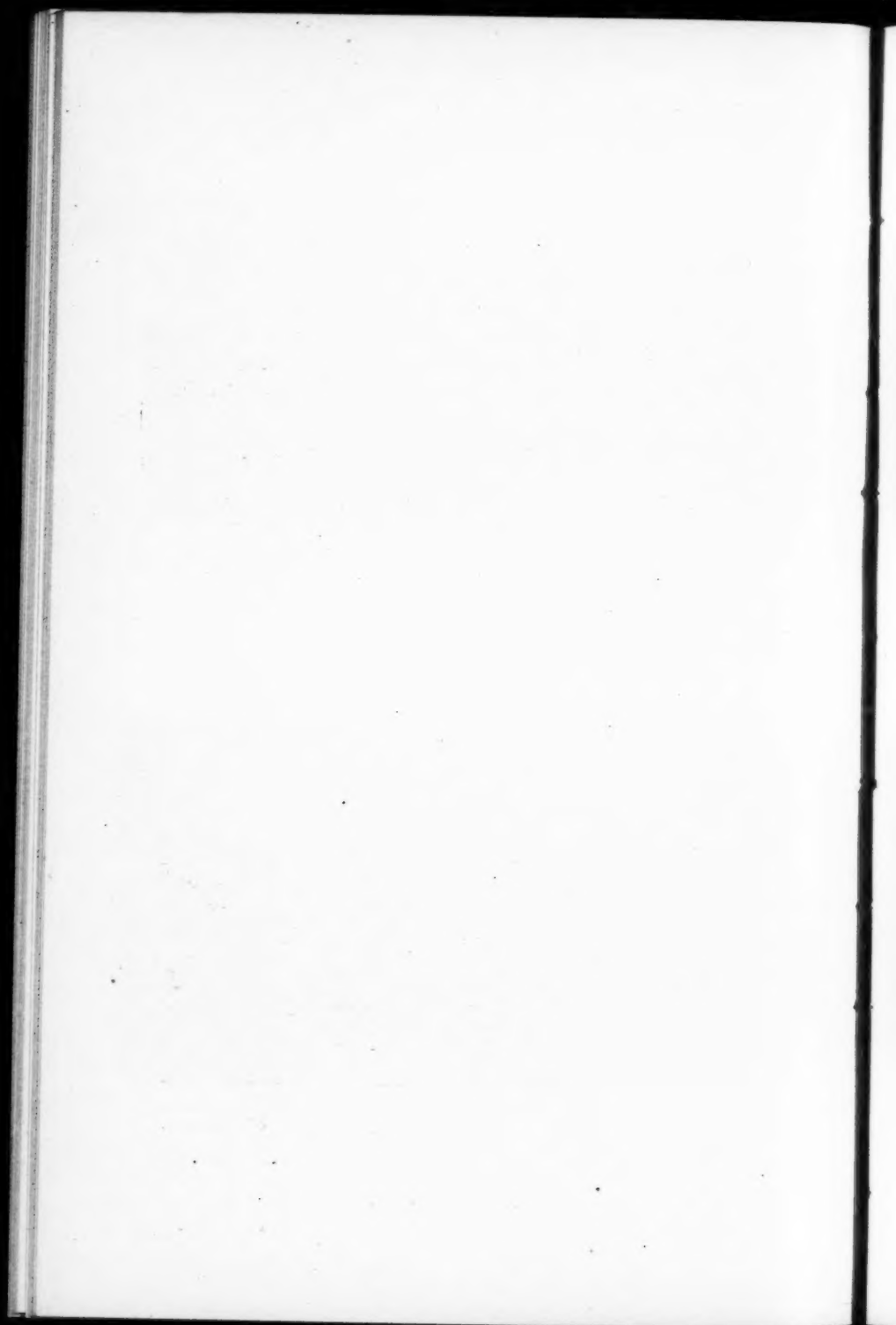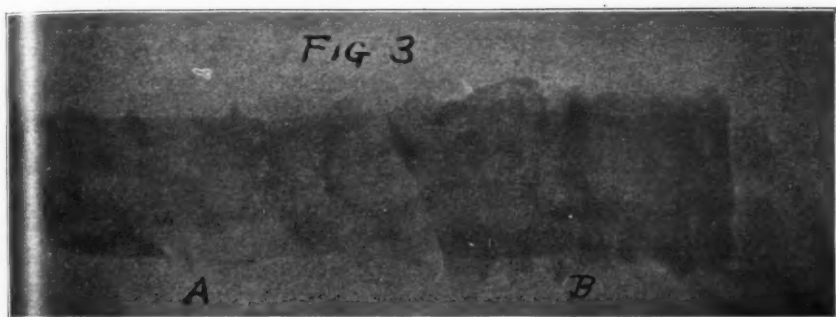
Fig. 3.—Skiagraph of moist intestinal mucous membrane. **A**—One thickness. B—Three thicknesses. Time of exposure two seconds.

Fig. 4.—Skiagraph of dried intestinal mucous membrane. A—One thickness. B—Three thicknesses. Time of exposure two seconds.
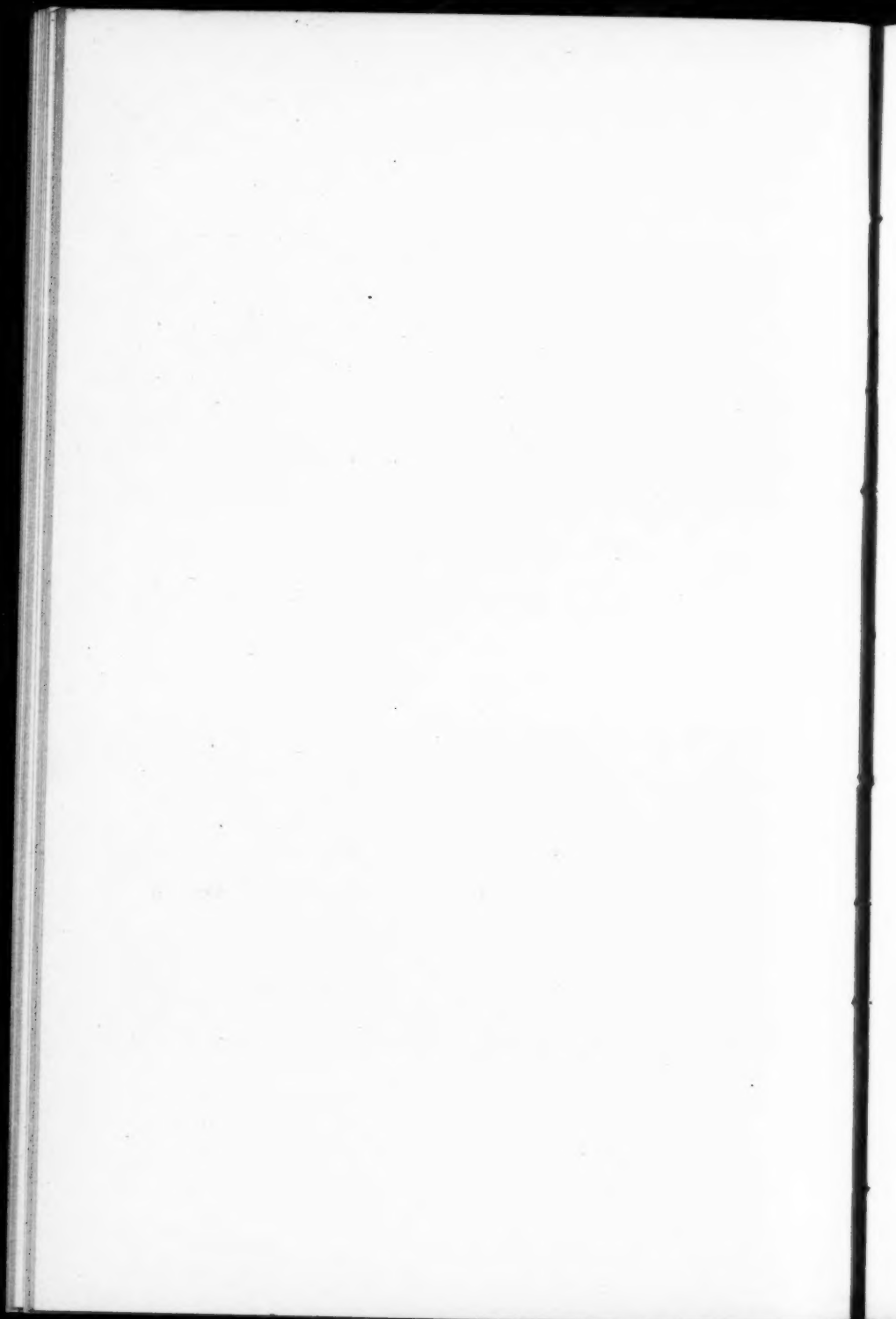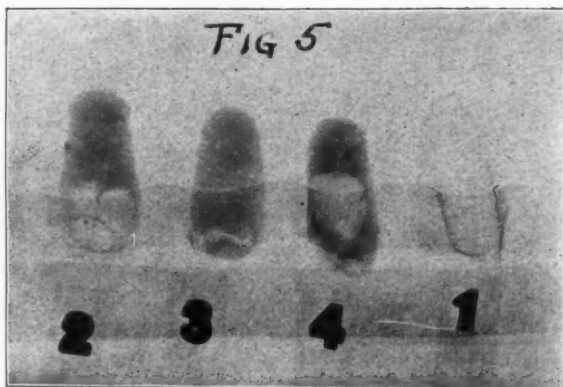
Fig. 5—Skiagraph of gelatine capsules containing (1) air, (2) pus, (3) saline solution, (4) blood. (2) and (4) show bubbles of air. Wavy band is strip of adhesive. Time of exposure one second.
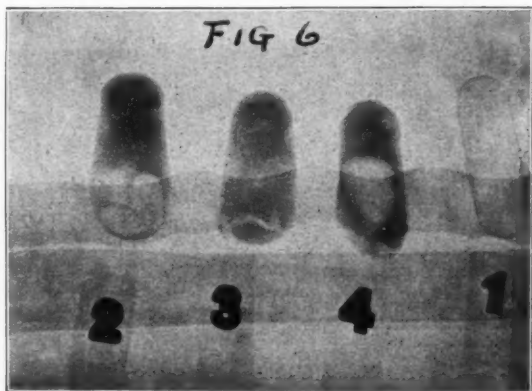
Fig. 6.—Skiagraph of gelatine capsules containing (1) air, (2) pus, (3) saline solution, (4) blood. (2) and (4) show bubbles of air. Wavy band is strip of adhesive. Time of exposure, two seconds.
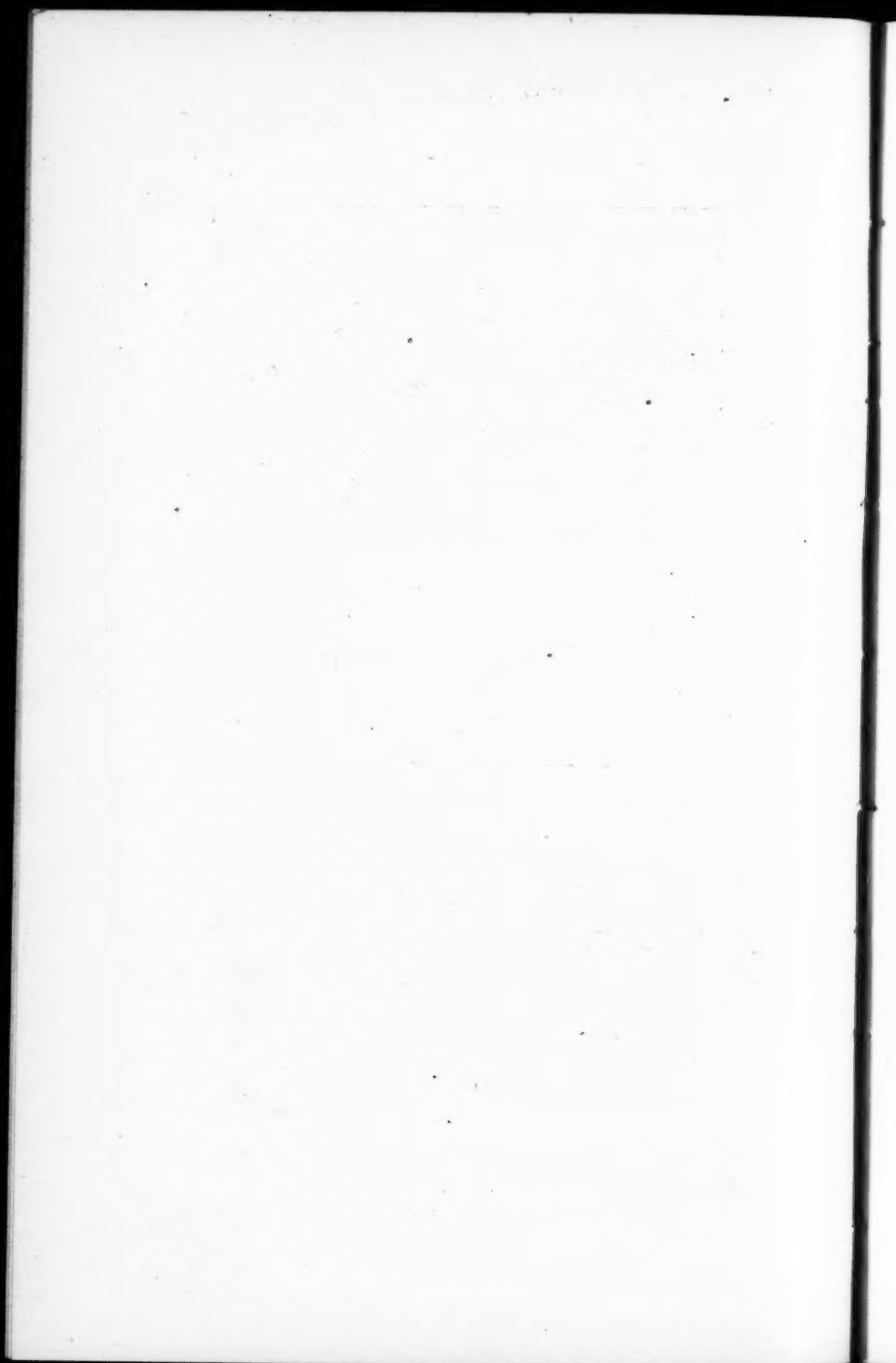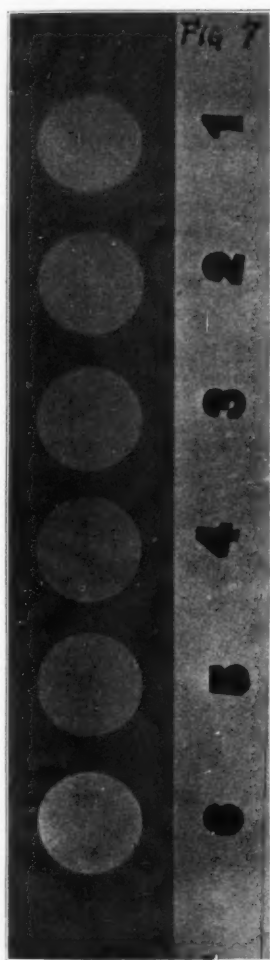
Fig. 7.—Skiagraph of receptacles in hard rubber, each containing two cc.'s of (1) gelatine, (2) pus, (3) blood, (4) saline sol., (5) water, (6) air. Time of exposure one-half second.
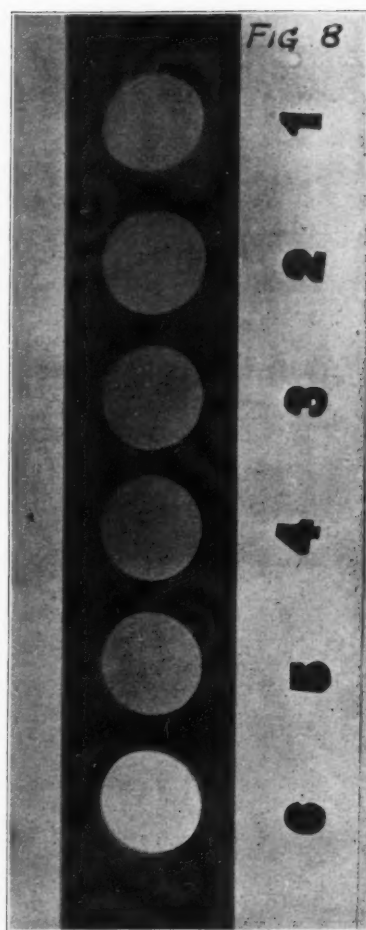
Fig. 8.—Skiagraph of receptacles in hard rubber, each containing two cc.'s of (1) gelatine, (2) pus, (3) blood, (4) saline sol., (5) water, (6) air. Time of exposure one second.
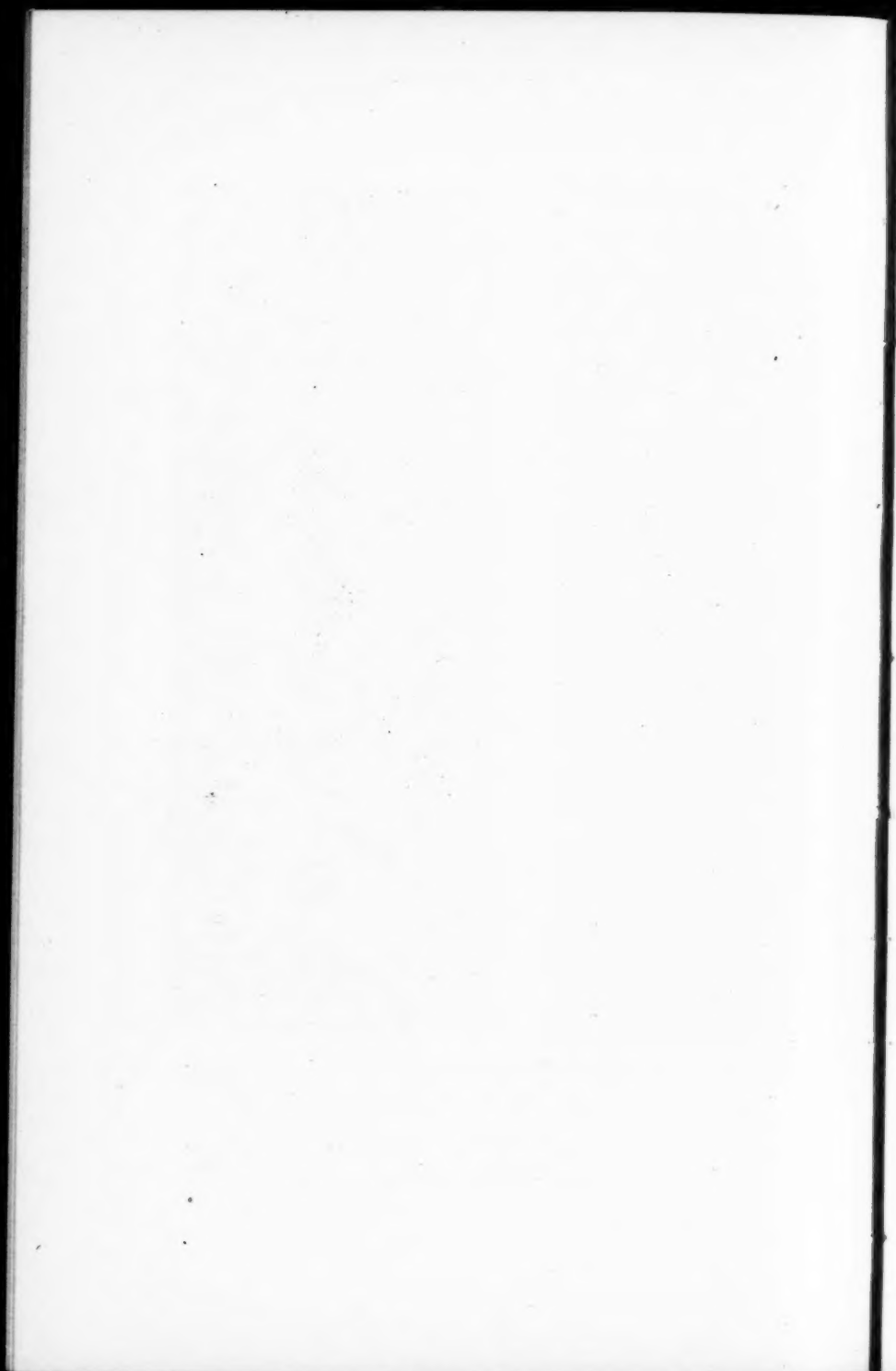
Fig. 9.—Skiagraph of head showing normal frontal sinuses, except that true bony septum is situated in what appears to be the middle of right sinus. Afterwards employed for gelatine injection. Time of exposure 30 seconds.
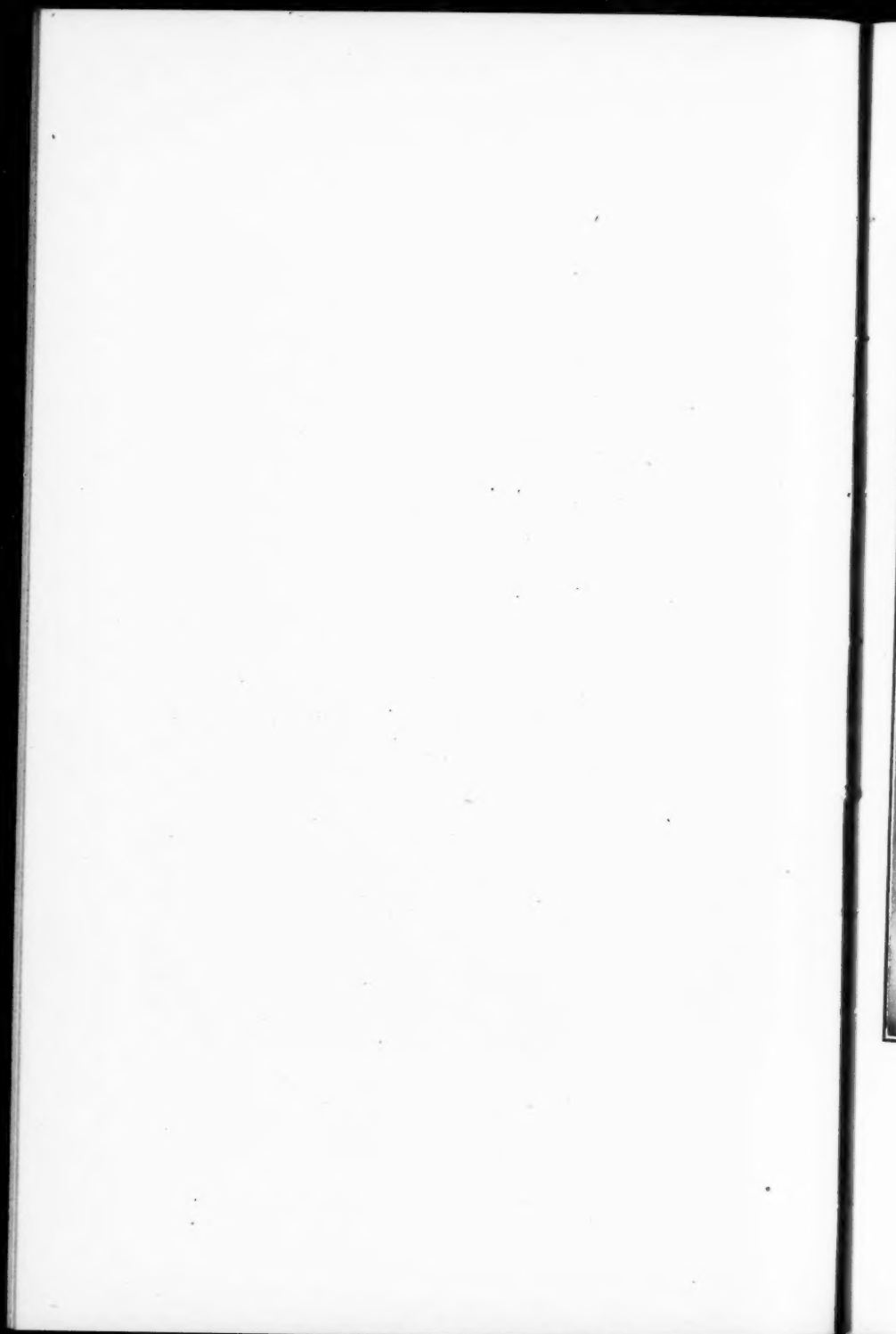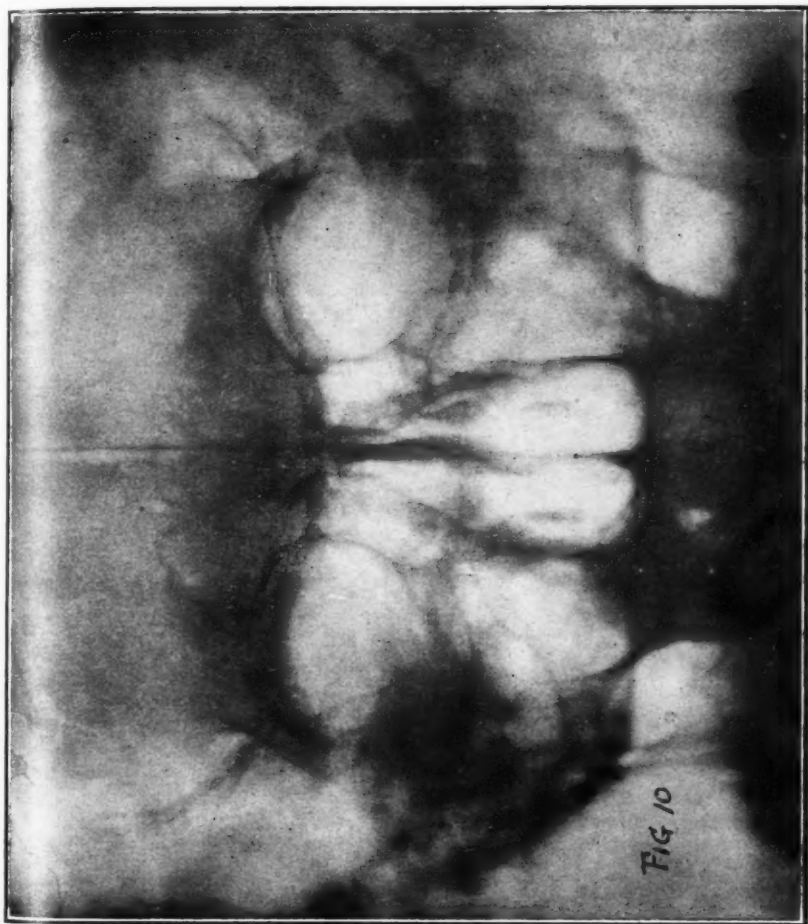
Fig. 10.—Skiagraph of head (represented in Fig. 9), showing large left frontal sinus filled with gelatine; small right sinus shows normal. Large left sinus extending far beyond median line is clouded and outline in distinct giving appearance identical with that of diseased sinus. Time of exposure 30 seconds.
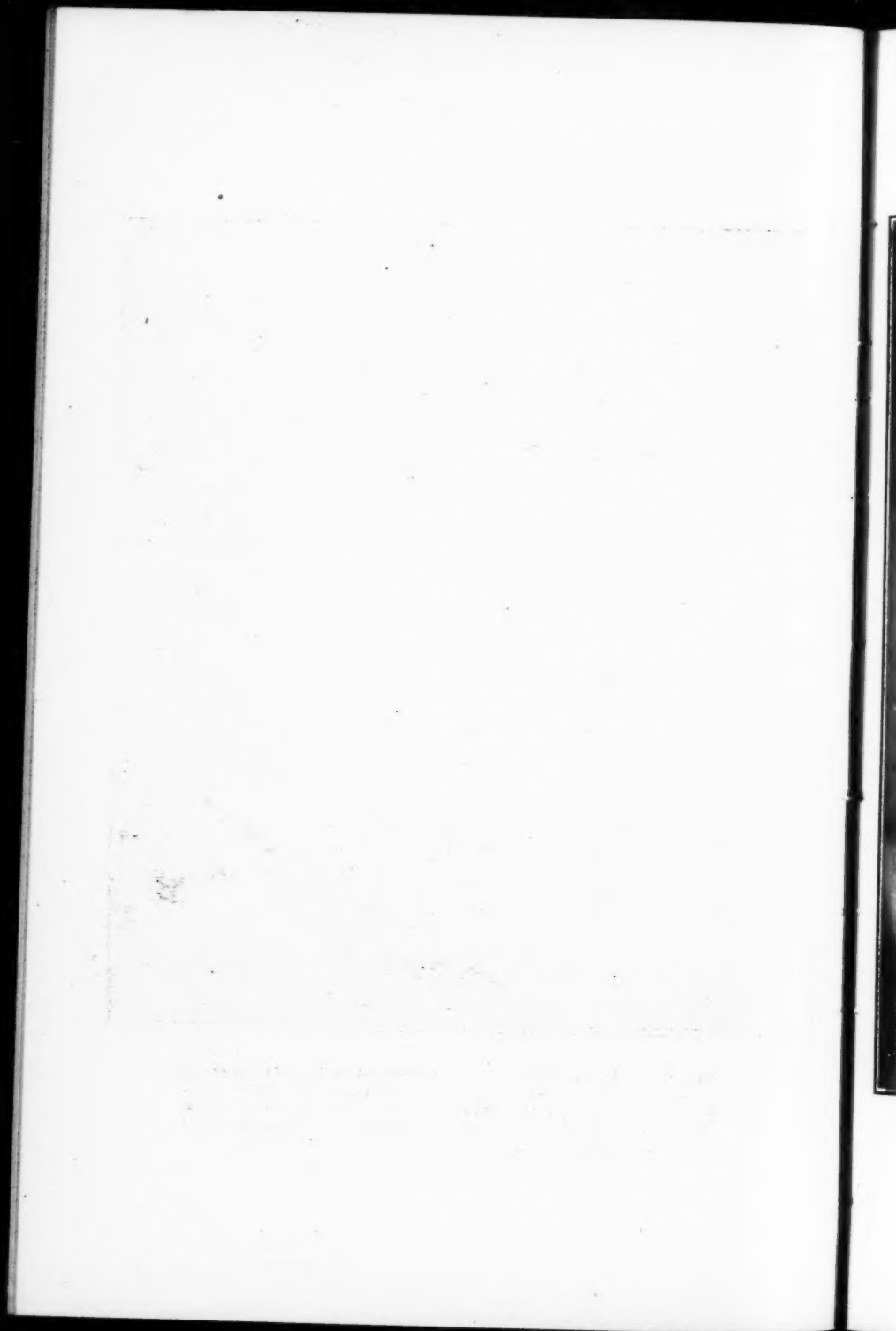
Fig. 11.—Skiagraph of head, showing right frontal sinus
normal, left diseased. Verified by operation.
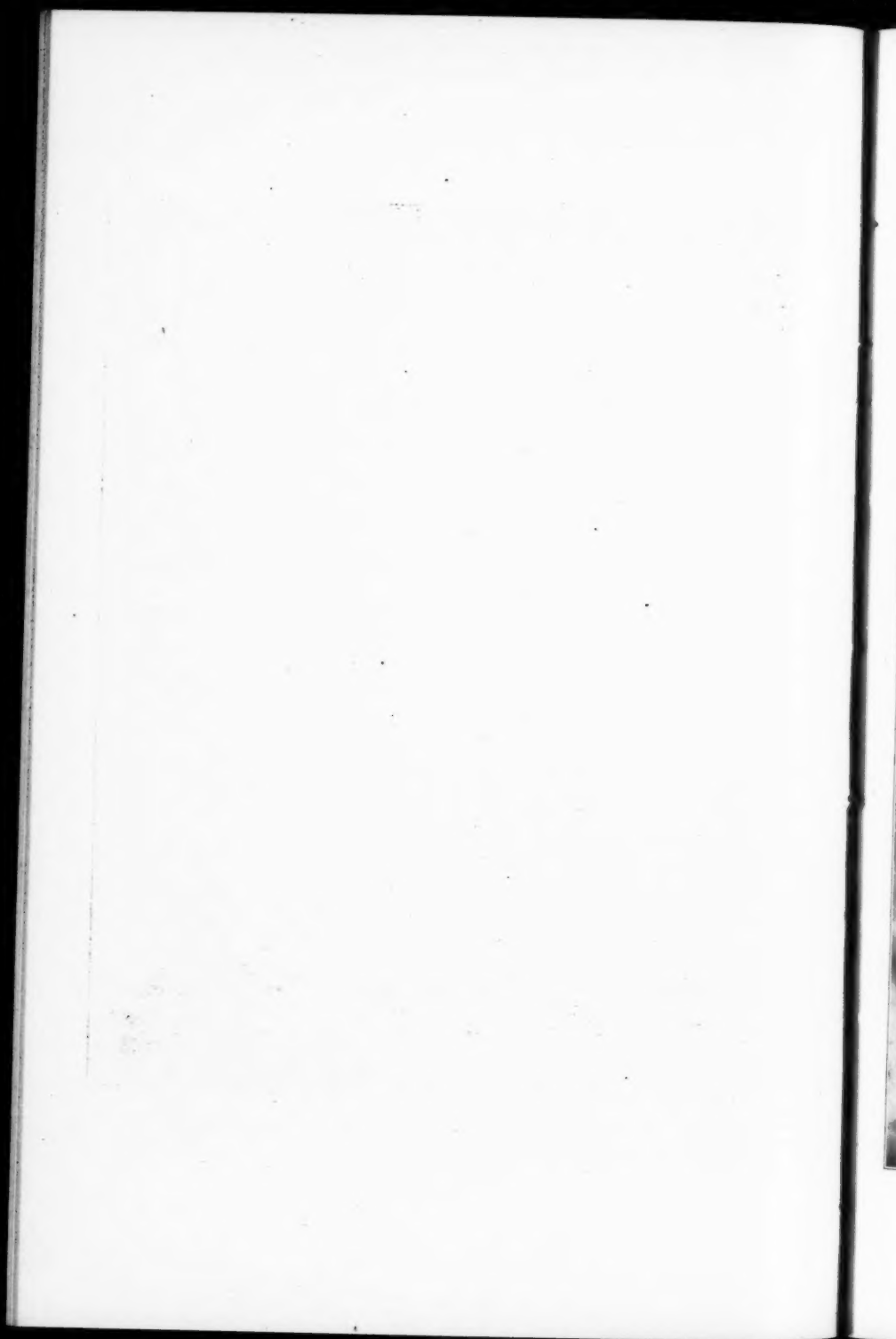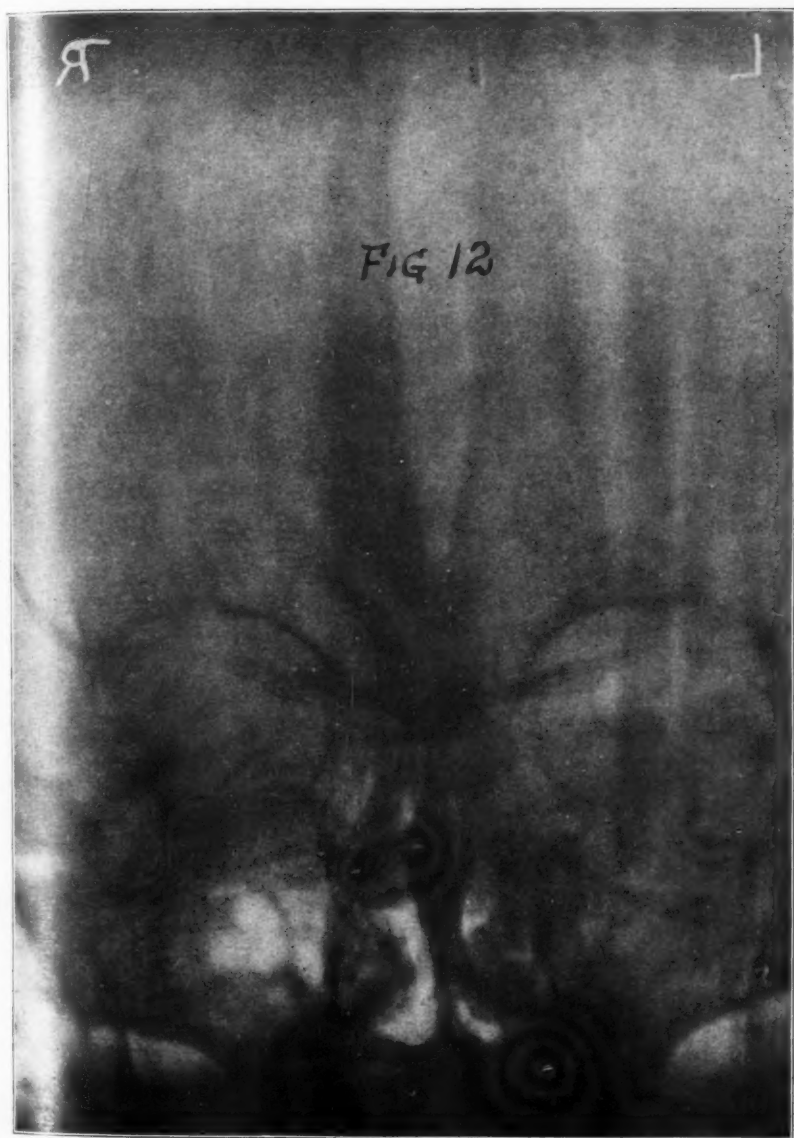
Fig. 12.—Skiagraph of head, showing small right frontal sinus normal; large left sinus extending far beyond median line is diseased. Verified by operation.
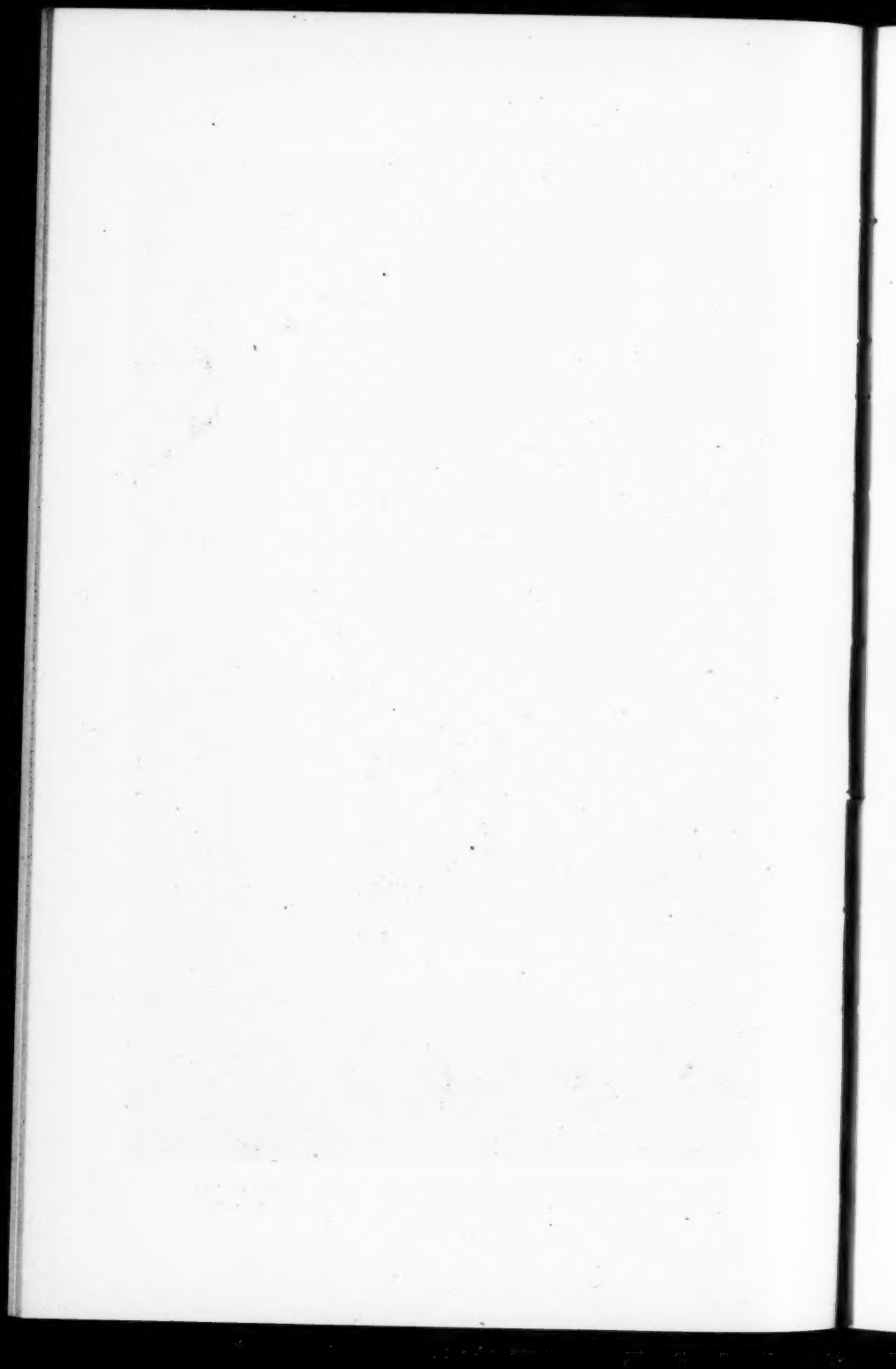
Fig. 13.—Skiagraph of head, showing right frontal sinus normal, left diseased. Verified by operation. Septum slants towards left.
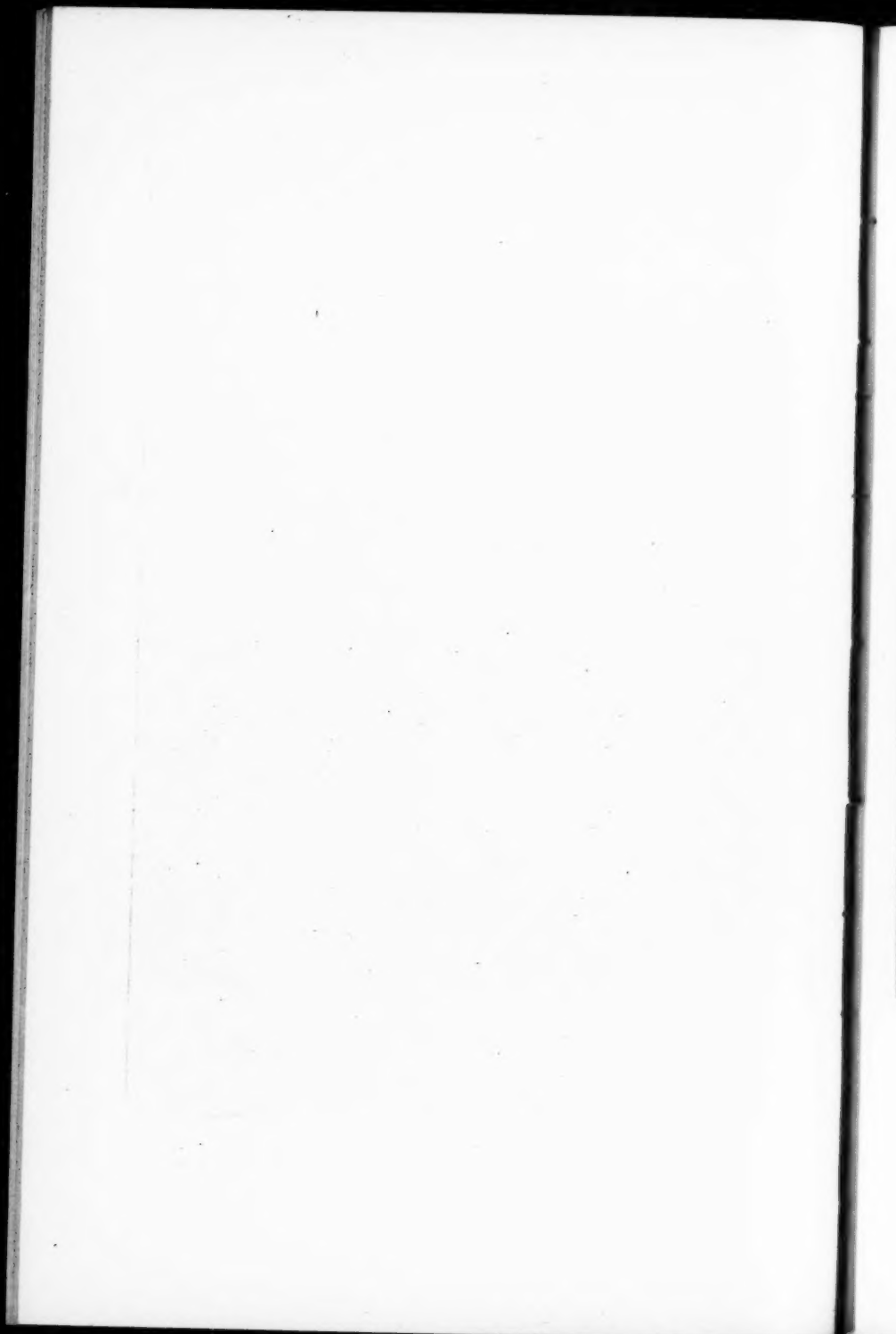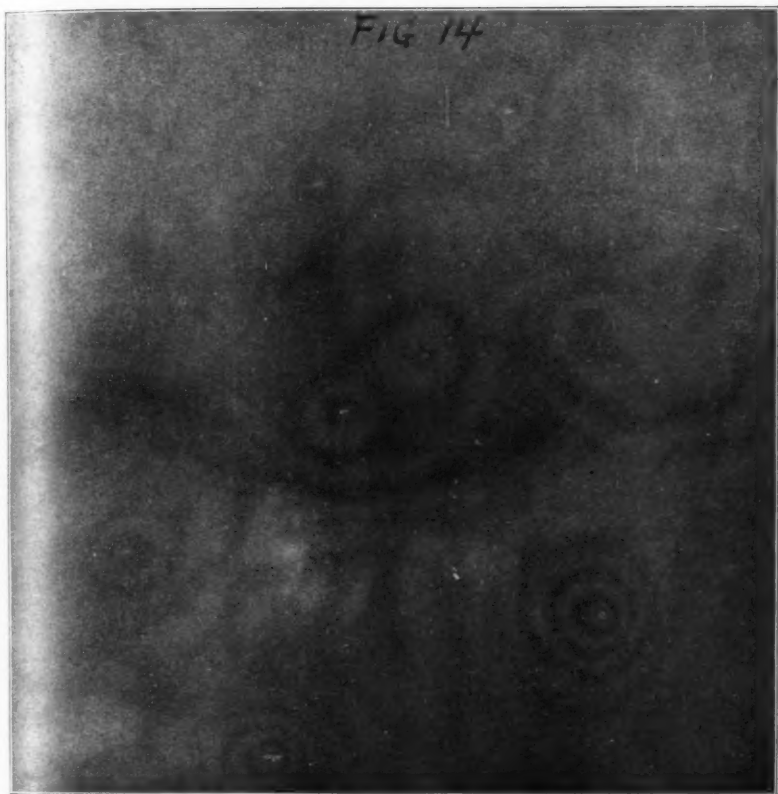
Fig. 14.—Skiagraph of head, showing normal left sinus, right sinus diseased extending beyond middle line and high up. Verified by operation.
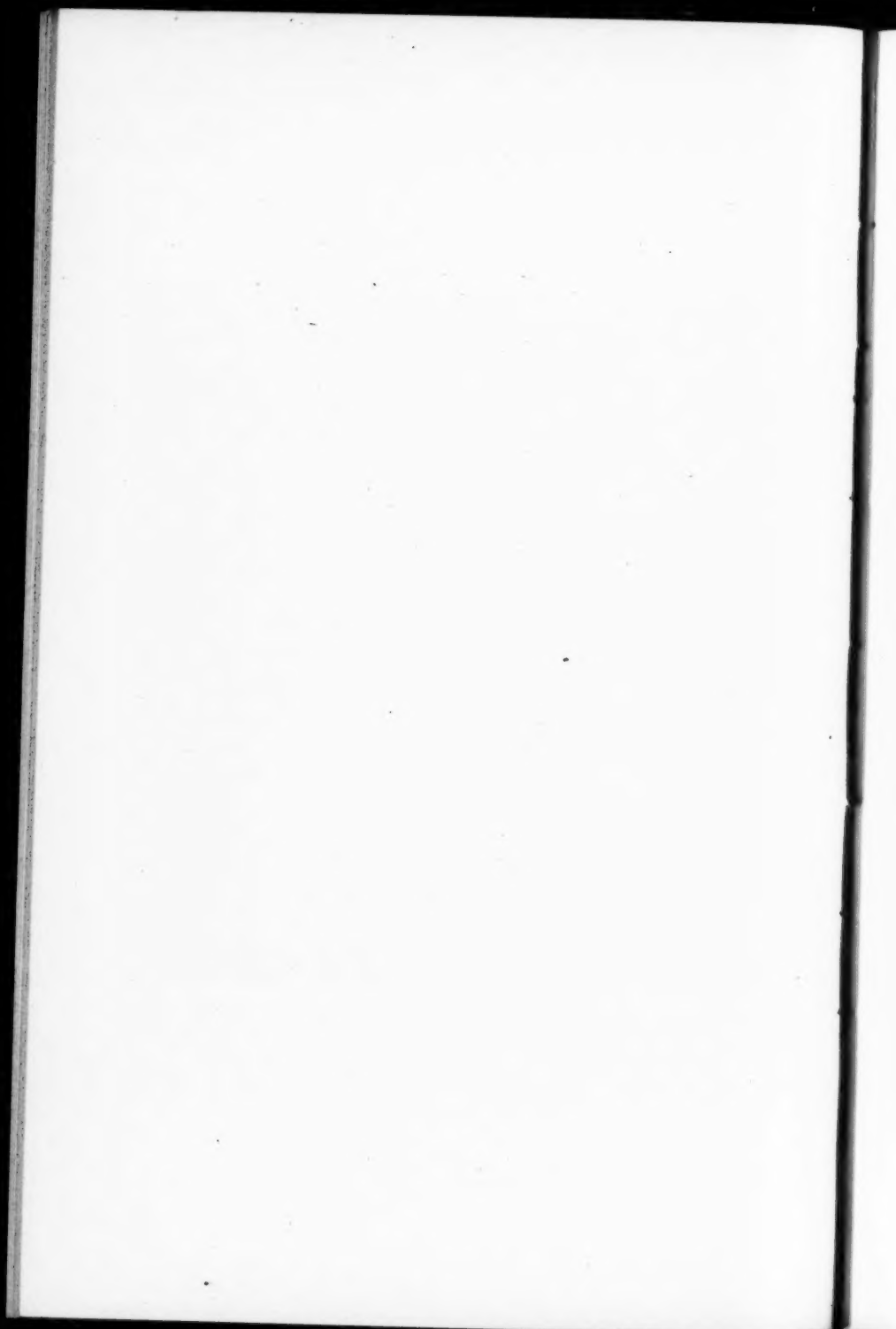
Fig. 15.—Skiagraph, showing frontal probe introduced into left frontal sinus. Right does not show having been previously operated upon, and obliterated by granulation tissue.
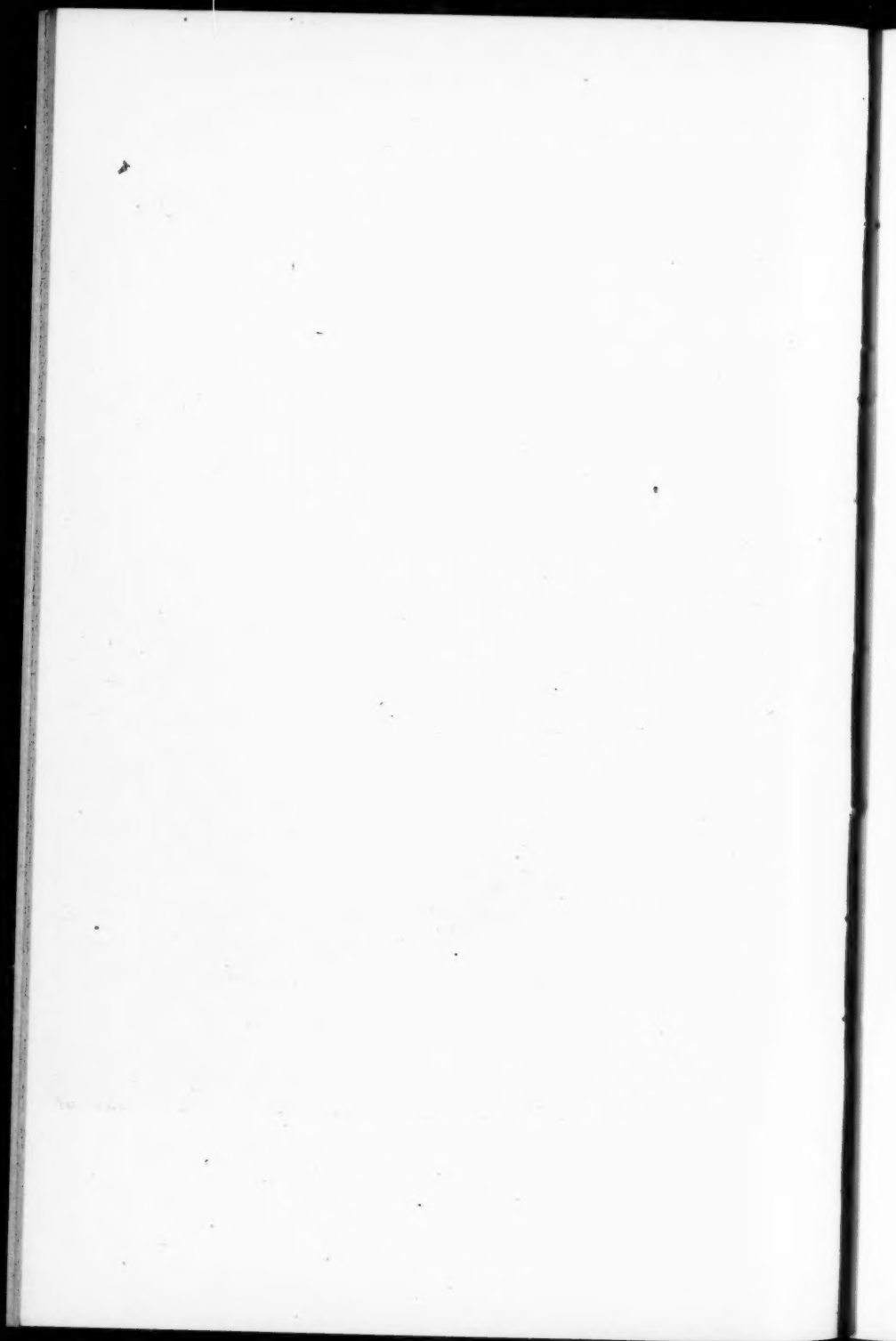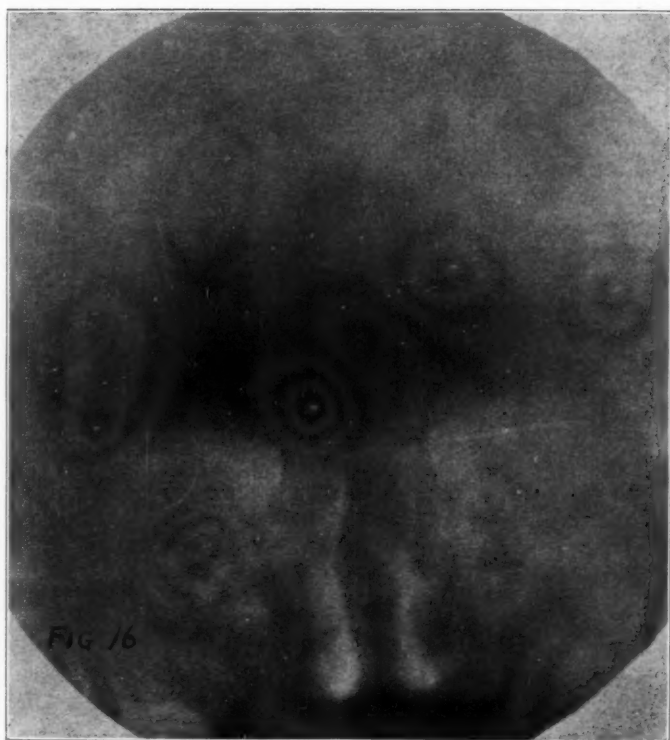
Fig. 16.—Skiagraph, showing absence of frontal sinuses.

LXXIV.
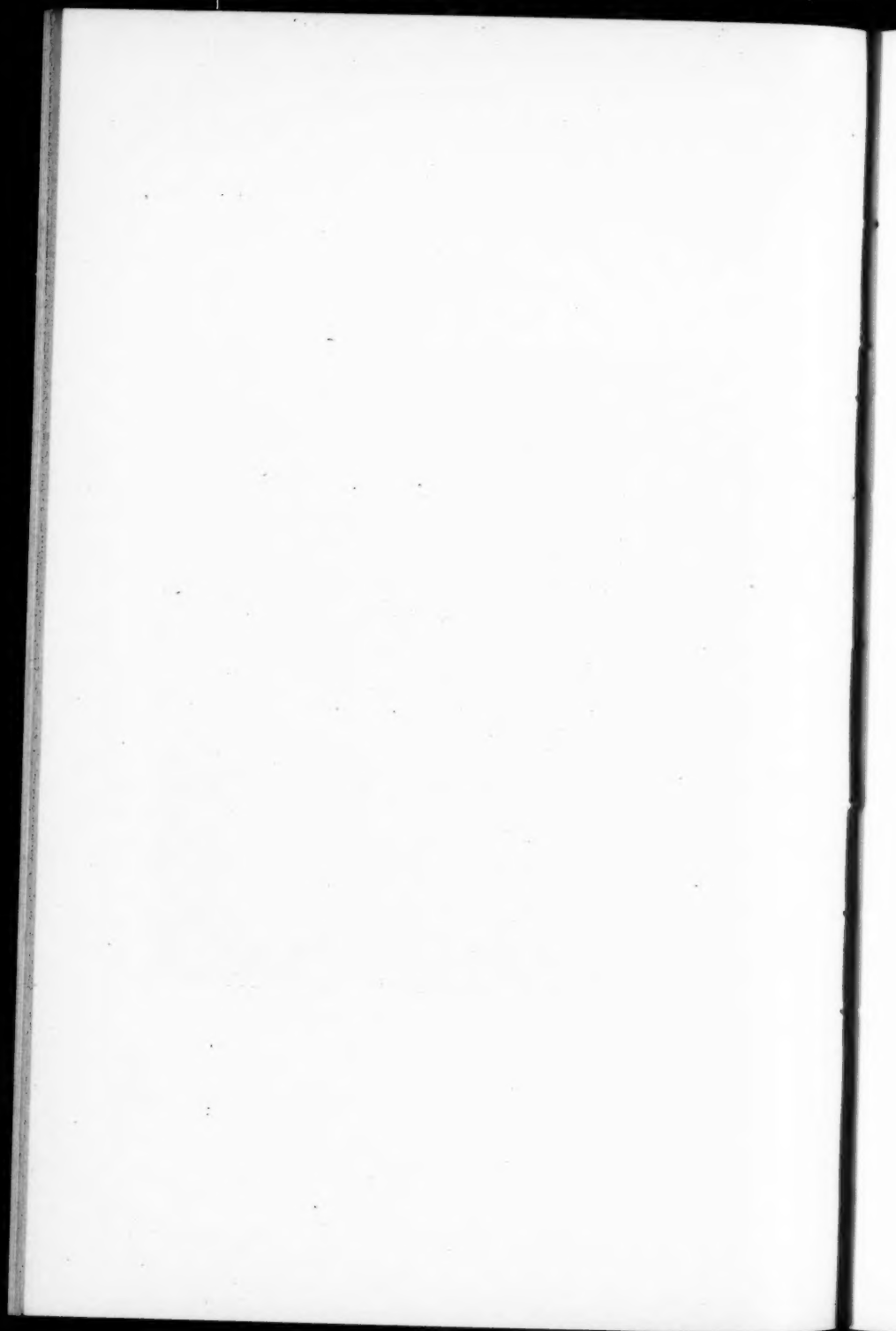
THE NASOPHARYNX AND THE THROAT IN THE DEAF MUTE.

By JAMES KERR LOVE, M. D.,

GLASGOW.

At first sight, a paper on the nose and throat in the deaf and dumb, however short, would seem unnecessary. Every otologist and rhinologist knows that the voice of the dumb is there and that the resonating cavities above the larynx will, if they are in health, modify the sound produced in the larynx, if only the deaf child can be taught to shape them properly,

On the other hand, unless the present writer interprets the signs of the times wrongly, we are on the eve of a revolution in the education of the deaf and dumb, and that revolution will be based on the examination of deaf mutes by the clinical observer.

At present there is no scientific classification of the deaf for educational purposes. In Germany all the deaf are taught to speak; in Britain, except as a mere accomplishment, only a small minority are taught speech; in America this speaking minority of the deaf is large but it is still a minority. And yet in these three countries, there is hardly any difference in the causes, the amount or the nature of the deafness which causes the dumbness. The state in Germany and the individual teacher in Britain and America settle the question of the deaf mute's education much as his religion and his politics are settled for him. Now, I have shown* that a careful clinical report made on the deaf mute after he has been a year in school will with scarcely any chance of error settle the method—oral and manual—by which he should be taught. Only in Denmark and Schleswig is any attempt made to classify deaf mutes scientifically, and although the clinical examination made there is somewhat primitive, it shows what may and must be done for the deaf before their education rests on any permanent or sound basis. Apart from

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*Deafmutism, 1896.

the primary duty of fitting the deaf to earn a living, the first duty of those in charge of them is to give the blessing of speech to as many as are fit to use it. Now amongst the deaf in all countries, from twenty to thirty per cent hear and distinguish vowels, consonants or words when these are loudly spoken into one or both ears. These are the semi-deaf. A much smaller class, the semi-mute, hear nothing, but because they have lost hearing after three years of age, speak a good deal. Such are the semi-mute.

So far as the general health of the patient is concerned, affections of the nose and throat have the same significance and require the same management in the hearing as in the deaf child. But in those deaf mutes who have some remaining hearing and in those who have some remains of speech, such conditions have a special importance. In all countries, as above stated, there are about twenty to thirty per cent of such semi-deaf and semi-mute children, and all such children should be taught orally. Oral teaching will be much more successful if the resonating cavities in the throat and nose are cleared of obstruction. There is scarcely a deaf mute institution in the world where this is regularly and systematically done.

The extent to which post-nasal adenoids and enlarged tonsils exist amongst the deaf and dumb probably does not differ much from that to which it exists amongst hearing children. Ten years ago, the writer examined the ears and nasopharynx in 175 children resident at the Glasgow institution, and he found that 70 per cent had enlarged tonsils, post-nasal adenoids or both. In 33 per cent. these growths were very well marked and the disturbance of breathing, the interference with speech or the effect on the general health of the child warranted removal in all these cases.

During the last three years, a hundred children resident at the same institution have been examined with regard to their hearing by a continuous tone series of tuning forks, whilst at the same time the state of the pharynx and naso-pharynx has been carefully noted. Thirty-two children had tonsils or post-nasal adenoids, or both, so well marked that removal was, in the opinion of the writer, advisable.

In orally taught pupils, the nose and nasopharynx should be cleared whether the growths present are causing general symptoms or not.

The subject discussed is in one sense only a small part of a very large one—The Medical Inspector of School Children.— But it is a part with a special interest, and when combined with the examination of the eyesight and the hearing, the clinical examination of deaf children is charged with consequences far more important to the deaf-mute than the mere medical inspection of hearing children. The latter has for its objects the detection of infectious disease, the discovery of defects of sight and hearing, the prevention of overpressure, etc. But the clinical observation of the deaf-mute must do not only all that the medical inspection of the hearing child does, but must in time become the basis of classification which will decide the method of his education. It will show that whilst it is useless to attempt to educate an intellectually dull child, who is totally deaf. by the oral method, it is educationally a crime to neglect the hearing and remaining speech of the semi-deaf and semi-mute and to educate these by any but the oral method.

LXXV.

PERSISTENT UNILATERAL HEADACHE, DUE TO NEVOID CHANGES IN THE BONE OF THE MIDDLE TURBINAL BODY.

By Wyatt Wingrave, M. D.,

PATHOLOGIST TO THE CENTRAL LONDON THROAT AND EAR HOSPITAL.

The pathology of severe focal headache is always an interesting subject, and this case is recorded partly from its instructive morbid anatomy, but also because it affords an explanation for the frequent want of success in treating the middle turbinal body by cautery and local depletory measures for symptoms attributed to hypertrophy of that structure.

The patient, a healthy looking male, aged 38, sought relief for severe and persistent frontal pain of three months' duration, dating from an attack of influenza.

The pain was referred to the left supraobital and frontal regions extending to the vertex and occasionally to the corresponding eye. It varied in severity, but never left him and was at times so acute as to interfere with his clerical duties and to cause him much anxiety. There were frequent attacks of coryza, which generally afforded partial relief.

He had been an athlete, was of regular habits, temperate in tobacco and alcohol, but thought that he was gouty and had a tendency to piles. His only illness of any importance was influenza, of which he had experienced several attacks, the last one leaving a persistent nasal catarrh which had, however, nearly disappeared, but in spite of special treatment, the pain did not diminish.

Upon examination, the right nostril was found to be quite free, but the left breathway was distinctly less in volume, due in part to a slight septal deviation, but chiefly to a marked hypertrophy of the left middle turbinal, which completely blocked the upper meatus. Probing was very painful, but yielded no evidence of bone lesion, and there was no sign of pus. Under cocain, the turbinal became pale, but diminished only slightly in size. On transilluminating, although the

maxillary and frontal sinuses were perfectly clear and symmetrical, it was felt that the unilateral pain, together with the tenderness and hypertrophy of the turbinal and the history, strongly pointed to some sinusal trouble, probably due to drainage obstruction.

Local sedatives, general depletion and bromides for a week affording no relief, the anterior end of the middle turbinate body was removed under alypin and adrenalin chlorid, by means of a Krause's snare, which cut through the bone with ease. This was followed by free hemorrhage, lasting about fifteen minutes, but the pain gradually ceased, and in the course of half an hour he left for home, perfectly comfortable. No discharge of any kind beyond bleeding attended or followed the operation, and subsequent probing revealed no evidence of sinusal abnormality. He made a rapid and complete recovery, and six months later reported that he had experienced no return of the pain and enjoyed complete freedom from any "running" from the nose.

The part removed was about the size of a large haricot bean, measuring 15x12 mm. On microscopic examination, the mucous membrane appeared normal, but the bone cancelli were found to contain very thin vessels, distended with blood and pressing on the walls. There was no evidence of lymphocyte infiltration or osteoplastic activity, such as is usually found in inflammatory sinusitis involving the bone. The distended vessels had extremely thin walls, consisting only of epitheloid cells, in striking contrast with the arteries which in some of the adjacent cancelli were quite normal. The condition which is strongly suggestive of a nevoid state, differs entirely from cavernous distension of the erectile tissue so common in the inferior turbinal which involves the mucous membrane only and not the bone.* Part of the bone was pneumatic and lined with normal membrane continuous with that of the ethmoid cells, a condition often found in hypertrophy of this part.

Although a moderate degree of congestion, both periosteal and endosteal, is often seen in sections of removed middle turbinals, in this case it was exceptional, and taken together with the striking coincidental disappearance of symptoms on removal, it may reasonably be interpreted as possessing a

*Lancet, June, 1894. Turbinal Varix.

causal relationship. The morbid changes may be regarded as a nevoid condition of the spongy bone, possessing no resemblance whatever to any inflammatory process, such as rarefying ostetis, necrosing ethmoiditis, suppurative sinusitis, etc.

The association of the middle turbinal body with headache and many reflex phenomena is familiar to all rhinologists, likewise its anatomic relation to the hiatus semilunaris, which plays so important a role in the drainage of the accessory sinuses, but in the former connection, treatment has been chiefly confined to cautery and other local applications to the mucous membrane only, while removal of the anterior end, including the subjacent bone, generally forms part of the radical treatment of the sinuses. The morbid anatomy of this case illustrates the uselessness of confining treatment to the mucous membrane only, which having already failed, considerably influenced the adoption of a more radical course.

The operation is extremely simple, there being no necessity for the use of punch-forceps, scissors, etc., when the turbinal is sufficiently prominent as to require removal. A strong and fine wire should be used, and if well pushed upwards and backwards, will readily engage and rapidly cut through both bone and mucous membrane. Care must be taken to avoid (1) simply stripping off the mucous membrane and soft parts, (2) not to exert any dragging or tearing force, since in patients over the age of 40 the ethmoid bone is so spongy and "biscuit-like" in consistence as to be extremely brittle. This remark also applies to the removal of polypi in old people in whom the osteoporotic changes in the ethmoid are well marked.

THE ETIOLOGY OF HYPERKERATOSIS OF THE TONSILS.

By Geo. B. Wood, M. D.,

PHILADELPHIA.

In the consideration of such a time-worn subject as "Hyperkeratosis of the Tonsillar Tissues of the Throat," it is not necessary to review the great quantity of literature which has been written on this subject. I might, however, call attention to an article by Sendziak, published in the transactions of the American L. R. & O. Society for 1905. In this article, Sendziak carefully reviews the greater part of the literature from Fraenkel up to the writing of his article. His conclusions are in accord with the original idea of Fraenkel; namely, that a specific infection by the leptothrix is the important etiologic factor in the production of this peculiar condition of the tonsils. It seems to me most unfortunate that such a view of the etiology of hyperkeratosis of the tonsillar tissues has been so recently resurrected. I had thought the idea of a specific relation between the leptothrix and this disease had been so firmly buried by Siebenmann and others that all thinking laryngologists had come to believe that the leptothrix was present purely as a saprophyte. There is a rather acute infection of the throat in which the leptothrix is probably the exciting cause. This infection, however, is not limited to the tonsillar tissues, but may occur in any portion of the body where the vital resistance has been lowered and the leptothrix organisms have gained access.

But because the leptothrix is a common inhabitant of the mouth, the throat is more frequently infected than are the other portions of the body. The clinical picture of the infection, however, is absolutely different from hyperkeratosis of the tonsils. Any part of the throat may be infected. There is an acute inflammatory reaction usually accompanied by a milky membrane, which may or may not leave a denuded surface on being detached. Also, there is very apt to be infec-

tion of the cervical lymph glands.   The condition is easily cured by the ordinary throat washes and runs an acute febrile course.

Hyperkerastosis of the tonsillar tissues of the throat is a disease, or better, a condition characterized by the appearance of numerous white projections, not only from the cryptal orifices of the tonsils proper, but also from the orifices of the lymph follicles on the posterior and lateral pharyngeal walls
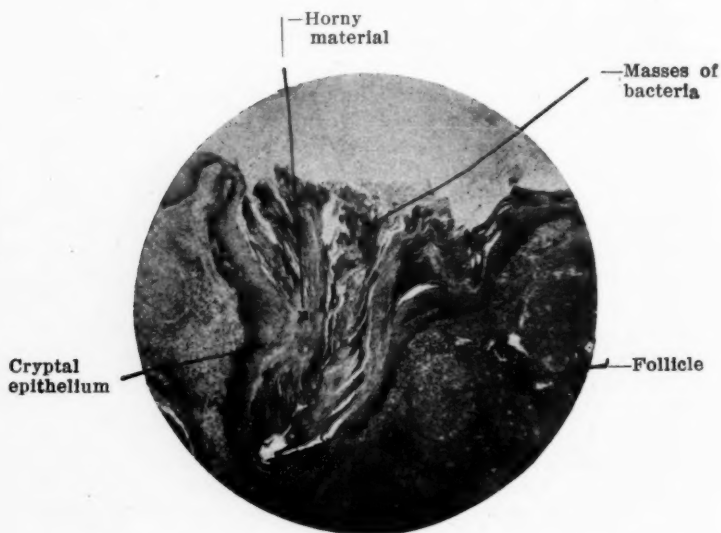
Fig. 1.—Hyperkeratosis.   Showing the typical appearance under low power.   The horny mass is growing from a comparatively small area of the cryptal epithelium and the plug shows the ordinary fraying of its edges.

and on the lateral glossoepiglotidian folds.   This condition does not occur on portions of the throat where there is no lymphoid tissue.   The lymphoid tissue of the upper respiratory tract, however, is so ubiquitous that occasionally we may see these little white projections on almost any part of the mucosa.   In the large majority of cases, the condition is limited to the faucial and lingual tonsils.   That it reaches its

greatest development at base of the tongue and at a position just behind the lateral glossoepiglotidian folds and the posterior part of the inferior poles of the tonsils, is due, almost entirely, to mechanical reasons. The contractions of the muscles during swallowing prevent food from coming in intimate contact with the surface of these parts, and, therefore, permit the projections to grow undisturbed. Although the
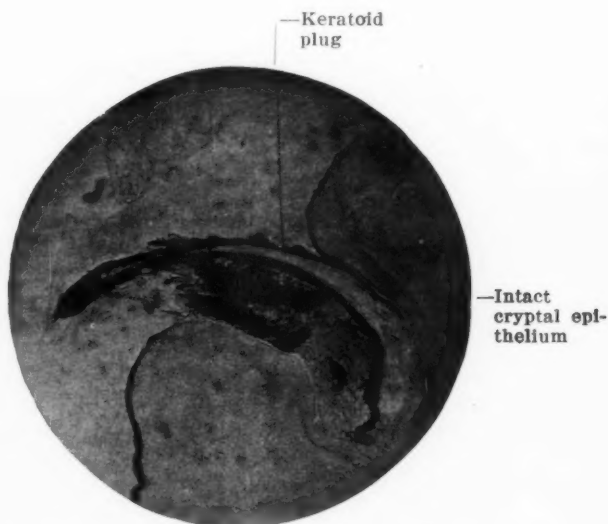
Fig. 2.—Hyperkeratosis, faucial tonsil. This specimen was from a case which had been vigorously treated with antiseptics. There are practically no micro-organisms. The black staining is due to nitrate of silver which had been used in treating the patient.

horny material is quite resistant to trauma, the bacterial accumulations which form the greater mass of the projections are easily brushed off, so that the size of the growth is much greater where it can be protected from mechanical disturbances.

The symptoms caused by this condition of the throat are either entirely wanting or very slight and due for the greater

part to the local irritation of the hard, horny plug. If they project from the base of the tongue so as to come in contact with the epiglottis there will probably be an irritating tickling sensation, causing a hacking cough. If they are so placed as to be compressed during the act of swallowing, they may give rise to a slight sticking pain. Occasionally, among the rich and varied bacterial flora which grows in such luxuriance on this horny material, there may lurk a germ possessed of more or less pathogenic power which can

—Intact epithelium.

—Hornified cells

—Lymphoid tissue.
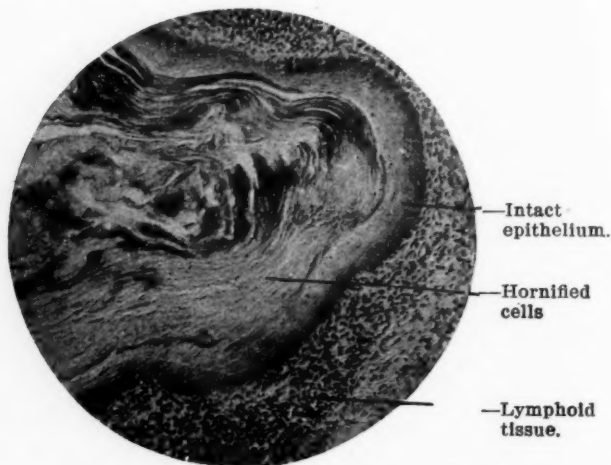
Fig. 3.—Hyperkeratosis. Cross section of a crypt filled with keratoid material and bacteria.

set up an accompanying inflammatory reaction in the tonsil or surrounding structures. Hence, the relation which some observers have noticed between acute tonsillitis and this disease.

To understand correctly the pathology and also the etiology of lacunar hyperkeratosis, we must turn our attention for a few moments to the anatomy of the normal active tonsil. The tonsil consists of four chief elements: the connective tissue, the germinating follicles, the interfollicular tissue and the crypts.

First: The connective tissue, that is, the trabeculae and reticulum, acts as a supporting framework to the tonsil substance proper. The trabeculae carry the blood vessels, the nerves and the lymphatics.

Second: The germinating follicles are the centers wherein the large mother cell of the leucocytic group undergoes karyokinesis and forms young lymphoid cells.
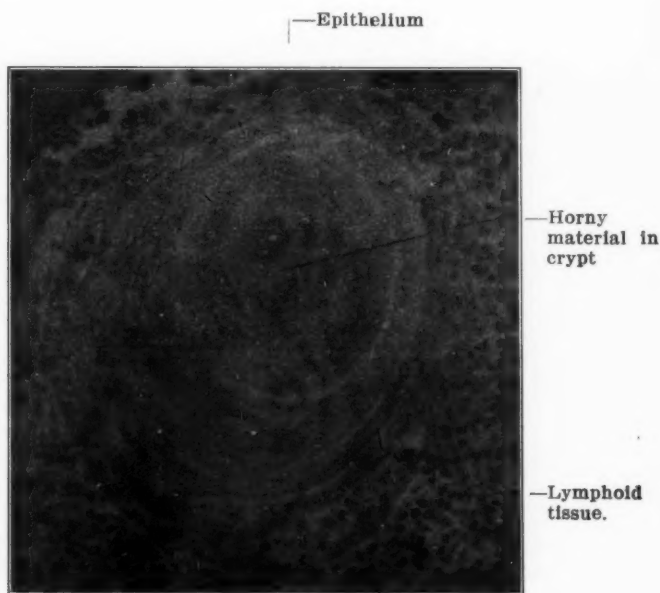
Fig. 4.—Hyperkeratosis. Cross section of the terminal portion of a crypt, showing the concentric arrangement of the layers of horny material and the epithelium, which is still somewhat disintegrated.

Third: The interfollicular tissue is made up of lymphoid cells in various stages of development. The cells making up this interfollicular tissue differ in size and shape according to their location. They are greater in number around the follicles, and show greater difference in their anatomic construction in the immediate neighborhood of the crypts.

Fourth: The crypt of the tonsil is its peculiar and most characteristic structure. It consists of an invagination of the epithelium from the surface of the tonsil, which has undergone a very interesting anatomical change. In the first place the subepithelial connective tissue which exists in a marked degree beneath the surface epithelium, disappears as soon as the epithelium starts to form the crypts. This permits the epithelium to come in direct contact with the

—Crypt

—Cryptal epithelium

—Lymphoid tissue.
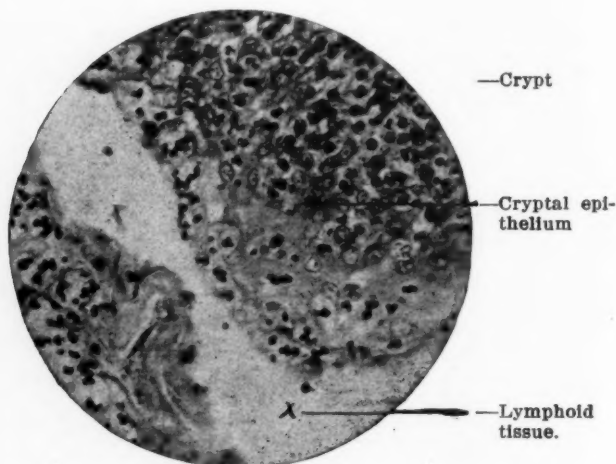
Fig. 5.—Hyperkeratosis. The epithelium here represented still retains its normal rarification, though in other portions of this same crypt there was typical hyperkeratosis. Numerous polymorphonuclear leucocytes are passing through the epithelium.

lymphatic structure of the tonsil, and very frequently it is impossible to distinguish a dividing line between the epithelium of the crypt and the interfollicular tissue. The epithelium of the crypt, unlike its progenitor which covers the surface of the tonsil, does not form a compact, unbroken barrier of protection. For the greater part of its extent it presents an intact line, only one or two or possibly three cells in thickness. Toward the parenchyma, the epithelial cells show a peculiar condition. They are separated from each

other by interposed cells varying in type from slightly changed epithelial cells to a well-formed lymphocyte. Also, the epithelial cells may extend from the crypt into the tonsillar substance, suggesting the ramifications of a malignant epithelioma. The smaller terminal invaginations of the cryptal epithelium are usually solid sprouts, frequently with central keratosed cores. The lumen of the crypt is formed by the subsequent exfoliation of the keratosed cells.

Lymphoid tissue

Epithelial cells, still retaining their normal absence of compactness.
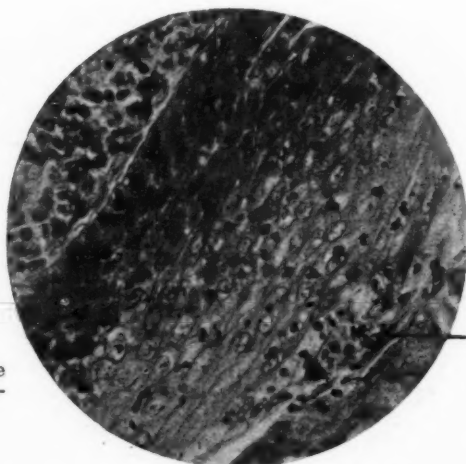
Polymorphonuclear leucocytes.

Fig. 6.—Hyperkerasosis. Showing polymorphonuclear leucocytes passing through the epithelium. This micro-photograph shows the cryptal epithelium beginning to lose its physiologic activity.

Turning now to hyperkeratosis, we find the epithelium of the crypts showing characteristic changes. In hyperkeratosis the epithelium loses its rarified condition and becomes an ordinary pavement, squamous epithelium similar to that covering the surface of the tonsil, except that generally it does not show the connective tissue papillae. The crypt of the tonsil is markedly dilated and filled with a horny mass, which merges at various points into the epithelium, though in sections stained with eosin and thionin there seems to be a more

or less distinct line where the epithelial cells become keratosed.
The living cell has a nucleus well stained with with thionin,
and its protoplasm is of a purplish color due to the mixed
staining with eosin and thionin. The keratosed material stains
only with the eosin and is, therefore, of a bright pink color.
Occasionally, in the keratoid mass, a very faintly stained
nucleus will be found indicating that the material of which
the mass consists has been originally derived from epithelial
cells. According to the mechanical circumstances by which
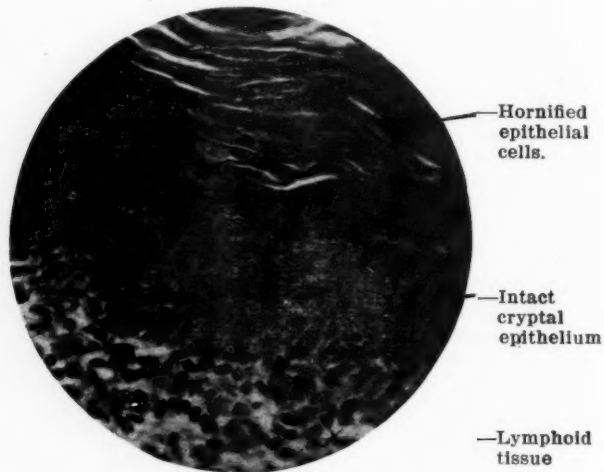
Fig. 7.—Hyperkeratosis. Section through the cryptal epithe-
lium, showing the formation of the keratoid mass from the epi-
thelial cells.

the tonsil is surrounded, the horny mass becomes sooner or
later broken up into layers between which multiply and grow
organisms of all varieties. This fraying of the cryptal plug
may take place within the crypt itself so that the resulting
fissures permit the bacteria at times to penetrate almost but
not quite to the living epithelium. Mitotic figures may be
seen in the epithelium at different places, but especially along
the border toward the parenchyma of the tonsil. The epi-

thelium is, therefore, in a state of active growth. This eccentric growth, however, which results in the formation of the keratoid plug is not equally distributed to all parts of the epithelial lining of the tonsillar crypts. Take, for instance, a single individual crypt; a portion of the epithelium may still persist in its normal condition of rarification without a discernible border line between it and the tonsil parenchyma; in another part the epithelium may exist simply as a barrier of cells with a very thin layer of subepithelial connective tissue, and again in the same crypt we may see the hyperkeratosis in its most beautiful and characteristic appearance.

This change in the epithelium of the crypts is the characteristic pathologic feature of hyperkeratosis. Besides this there are generally other changes in the tonsil. The connective tissue is usually increased in amount, the trabeculae are thicker and in some cases the subepithelial connective tissue extends from the surface epithelium for quite a distance down along the crypt. The follicles are small and much less numerous and the surrounding zone of lymphocytes has become comparatively insignificant. The mitotic figures in the follicles, though present, are less numerous and the whole aspect of the organ is one of suppressed activity. We find, however, sometimes signs of local irritation in the immediate neighborhood of the crypts, as evidenced by the outwandering of polymorphonuclear leucocytes from the capillaries and their penetration between the cells of the cryptal epithelium. This irritation is easy to understand when we consider that the crypts contain large numbers of saprophytic and probably also pathogenic micro-organisms growing actively and receiving their nutriment from the accumulated keratosed cells. The toxins elaborated by these organisms must be absorbed to a greater or lesser extent by the tonsillar tissue. It is probably due to the fact that the cryptal epithelium has lost its normal physiologic rarification and has become an impact protective barrier that a more noticeable reaction is not a common result.

In a paper published last fall on the "Functions of the Tonsil," I endeavored to show that the epithelium of the crypts was in a state of active growth and that the epithelial cells were undergoing a metamorphosis, the result of which was the formation of lymphoid cells. Since then further study on the subject has increased my belief in this theory,

especially as I have been able to demonstrate that the cryptal epithelium of the normal tonsil shows a sufficient number of karyokinetic figures to indicate a rapid growth. At the time of the publication of my paper, I did not believe that mitotic figures could be found in the epithelium of the deeper portions of the crypts, but other phenomena suggesting rapid increases were so noticeable that I concluded that the cells were undergoing a mitotic division. Recently I have seen in undoubted epithelial cells numerous mitotic figures showing all the stages of karyokinesis. The phenomena which previously led to the belief that the epithelial cells of the crypts were in a state of active growth, was the constant finding of keratosed and desquamated cells in the lumen of the crypts and the penetration of the deeper cells of the epithelium into the interfollicular tissue. In some forms of hypertrophied tonsils this penetration reaches such a high degree that the epithelium may almost completely surround some of the germinating follicles.

It is scarcely convenient in this paper to reiterate the various reasons why I thought the epithelium of the crypts of the tonsils was a primogenial source of lymphocytes, and it may be that until this metamorphosis can be proven as clearly as that one and one make two, the majority of anatomists will be inclined to doubt its possibility. For the purpose of this paper the proof of this metamorphosis is not absolutely necessary, but I desire to emphasize the fact, namely, that the cryptal epithelium in the normal and hypertrophied tonsil is for some reason or other in a state of active growth.

Several years ago I made the statement concerning the etiology of hyperkeratosis of the tonsillar crypts, that the increased growth of the epithelium forming the keratoid plug was probably due to a low grade inflammatory condition of the tonsillar parenchyma. I based this erroneous idea on the following rather peculiar phenomena: In the removal of a portion of a tonsil by an instrument, such as the tonsillotome or snare, which compresses the organ at the line of the separation, there will be found near the line of removal numerous elonged nuclei closely resembling leucocytes in an active state of diapedesis. At that time I believed that these compressed leucocytes were the result of some chemotactic attraction, and hence indicative of inflammation. As there were no other inflammatory changes, I concluded that the inflam-

mation must be of a low grade. Since that time I have been convinced that these peculiar elongated cells are the direct result of mechanical compression either in the removal or handling of the specimen. On the other hand, the tonsils showing hyperkeratosis of the crypts are almost always small and more or less atrophied, and under the microscope show an increase in the connective tissue with a decrease of lymphoid tissue and secondary follicles, so that we have a picture of functional quietude.

The functional activity of the tonsillar epithelium (permitting me to reiterate) is growing both superficially and internally. Now it is conceivable that if an organ with a peculiar physiologic growth manifested in two directions is for some reason deprived of its ability to increase centrally, it may double its growth peripherally. In other words, suppose the cryptal epithelium has ceased to penetrate into the parenchyma of the tonsil, its tendency toward growth causes an increased output of superficial or keratosed cells. Again, the disintegration of the epithelium permits an outpouring from the tonsillar parenchyma of numerous leucocytes, and probably more or less fluid secretions which, mingling with the accumulating epithelial cells, cause their disintegration and consequent exfoliation. When the physiologic activity of the epithelium has ceased, the epithelial cells revert to their original type and form an intact squamous pavement epithelium. The extravasation of leucocytes and fluids through this intact epithelium is rather difficult, and the growing superficial cells can accumulate in the crypt until a greater or smaller mass of keratoid material is formed.

This, then, is the raison-d'etre of hyperkeratosis of the lacunae of the tonsillar tissues of the throat, namely, a decreased functional activity of the tonsil while a portion of the cryptal epithelium still possesses its physiologic tendency toward growth.

It must be admitted that this theory is more or less open to criticism, because there are certain happenings regarding this peculiar condition which are somewhat difficult to harmonize. If this condition is due to decreased functional activity, why is it that tonsils generally atrophy without more manifestation of a hyperkeratosis? The vagaries of life are so great and so numerous that it is always easy to hide unexplainable phenomena under the cloak of life's mysteries, and

I understand that in a scientific article one can scarcely be excused for seeking such a refuge. Such is the case, however, and I must be pardoned for being unable to explain why the epithelium of some tonsils retains a portion of its physiologic property, while losing the remainder, just as I cannot explain why one individual is practically immuned from small-pox while another is most susceptible. It may be that the influence of certain toxins, possibly of microbic origin, exerts just the proper amount of stimulation which the epithelium requires for increased growth, or it may be something else, but to me it seems much more probable that hyperkeratosis of the tonsillar crypts is a pure vagary of function on the part of the epithelium of the tonsillar lacunae.

The facts and theories which have just been advanced would indicate the uselessness of any local treatment other than the destruction of the tonsil'ar crypt, and clinical experience bears out this view. Almost all of these cases after a period varying from a few months to a year or more, tend to recover spontaneously. Further, the condition is generally seen at that time of life when the tonsils are atrophying, and in a large majority of cases the size of the afflicted tonsil is already insignificant.

In conclusion, I want to place particular emphasis upon the importance of disassociating the leptothrix or any other micro-organism from an etiologic relationship with lacunar hyperkeratosis of the tonsils. It would be as rational to hold the grime and dirt of a miner's hand responsible for the production of the horny layer of the skin as it would to believe that the saprophytic leptothrix is the causative element in the production of what is really a calloused tonsil.

BIBLIOGRAPHY.

1 Fraenkel, B.   Berlin. klin. Wchnschr., 1873, p. 94.

2 Fraenkel, B.   Zeitschr. f. klin. Med., iv, 1882, p.   288.

3 Gruning.   Arch. f. Lar., No. 3, 1882.

4 Toeplitz.   Ueber Pharyngomycosis leptothricia benigna.   New Yorker Medical Presse, Dec., 1886, p. 13.

5 Vanderpoel.   Pharyngeal Mycosis.   New York Med. Journal, Feb. 9th, 1889, p. 147.

6 Heryng.   Ztschr. f. klin. Med., vii, 188.

7 Jacobson.   Volkmann's Samm. klin.   Vortr., No. 317.

8 Miller, W. D.   "Die Mikroorganism "der Mundhöhle," 1889.

9 Rice, C. C.   Chronic Inflammation caused by leptothrix buccalis.   International Clinics, October, 1891, Vol. iii, p. 343.

10. Spaans.   Mycosis pharyngis leptothricia acuta, Brit. Med.
      Journal, Epit. of Lit., Feb. 13th, 1892.

11 Dubler.   Der Halsorgane von einem 8-monatlichen Knaben
      mit Leptothrixmycose des Larynx, Pharynx and Oesophagus.   Correspondenzblatt. f. Schweizeraertze.   Jahrg.,
      xxii, 1892, p. 78.

12 Hemenway, H. B.   Journ. of Lar., Rhin. and Otol., Vol. vi,
      Feb., 1892, p. 53.

13 Semon.   Mycosis   Pharyngis   Leptothricia   and   Keratosis
      Pharyngis. St. Thomas Hos. Reports of 1893, Vol. xiii,
      p. 127.

14 Cheatham.   Leptothrix Mycosis of the Tonsil, Pharynx and
      Base of Tongue.   Am. Practitioner and News, May 20,
      1893, 361.

15 Wroblewski.   Beitrage zur Pathologie und Therapie der Zungentonsillen. Wien med. Presse, 1893, p. 174.

16 Grant and Wingrave.   A Case of Pharyngo-mycosis.   Journ.
      Lar., Rhin. and Otol., April, 1893, p. 174.

17 Seifert.   Die Pathologie der Zungentonsillen. Archiv. f. Lar.,
      u. Rhin., 1893, Bd. i, p. 69.

18 Siebenmann.   Archiv. f. Laryng. u. Rhin., 11, 1894-5, p. 365.

19 Dunn.   A Case of Mycosis of the Pharyngeal Tonsil.   N. Y.
      Med. Jour., July 28, 1894, p. 112.

20 Ingals.   Mycosis of the Pharynx and Tonsils.   N. Y. Med.
      Jour., Sept. 1, 1894, p. 261.

21 Thoman, H. M.   Pharyngo-mycosis.   N. Y. Med. Rec., 6th
      Jan., 1894.

22 Glasgow, W. C.   Mycosis of the Pharynx.   The Cincinnati
      Medical Journal, Feb., 1894, p. 51.

23 Sendziak.   Rev. de Laryngol., Par. 1894, xiv, 228.

24 Seifert, Otto and M. Kahn.   Atlas der Histopathologie der
      Nase, der Mundrachenhöhle und des Kehlkopfes, 1895.

25 Lake, R.   Tonsillar Mycosis.   Jour. Lar., Rhin. and Otol., Feb.,
      1895, p. 164.

26 Wright, J. A.   A Few Remarks on Some Cases of Mycosis of
      the Nose and Throat. N. Y. Med. Journal, July 6th,
      1895, p. 1.

27 Kelly, A. B.   Mycosis Pharyngis Leptothricia and Keratosis
      Pharynejis. The Glasgow Med. Journal, No. 11, Aug., 1896.

28 Goodale.   Journ. Boston Soc. Med. Sc., 1897, 8, 11, 204.

29 Wright, J.   The Laryngoscope, iv-v, 1898, p .221.

30 Wood, Geo. B.   The Pathogenesis of Lacunar Keratosis of the
      Tonsil. U. of P. Med. Bull., Jan., 1902.

31 McKinney.   A Case of Mycosis Tonsillaris Affecting both Tonsils, Completely Cured by Removal of the Tonsils by Electrocautery Dissection. J. A. M. Ass'n, 1903, xi, 991.

32 Colwell, N. P.   Mycosis Pharyngis Leptothricia and Keratosis
      Pharyngis.   The Illinois Med. Journal, Dec., 1903, p. 480.

33 Onodi and Entz. Ueber Keratosis Pharyngis. Archiv. f. Lar.
      u. Rhin., 1904, xvi, p. 265.

34 Fricker. Zur Jodreaktion einiger Leptothrixarten der Mund-
      höhle und des Magens. Centralbl. f. Bakteriol. u. Para-
      sitenk., Vol. 36, 1904.

35 Wood, Geo. B. The Functions of the Tonsils. U. of P. Med.
      Bull., Oct., 1904.

36 Sendziak, John. The Etiology and Treatment of Mycosis Oc-
      curring in the Upper Respiratory Tract. Annals of Otol-
      ogy, Rhinology and Laryngology.

LXXVII.

LARYNGEAL PHLEGMON.

By Norval H. Pierce, M. D.,

PROFESSOR OF OTOLOGY IN THE CHICAGO POLICLINIC AND POST-GRADUATE SCHOOL.

CHICAGO.

It might occur to the reader's mind, after having perused this thesis, that a more adequate title would have been "Infectious Phlegmon of the Pharynx and Larynx" than the one chosen for it. Primary laryngeal phlegmon is a very rare occurrence, the laryngeal process being nearly exclusively secondary to pharyngeal phlegmon, and in reviewing the literature on the subject, that relating to the pharynx is so closely intermingled with that relating to the larynx that the two can scarcely be dissociated. Another phase of the question is as to the identity of phlegmon and erysipelas in these regions. Those of us whose memory runs so far will remember the voluminous and, in some quarters, rather acrid controversy which followed the appearance of Senator's paper in 1888.

The writer's position in the present thesis is the one maintained by Küttner, Beckhäler, Onodi and others. namely, that although phlegmon and erysipelas may be etiologically identical, and, as they affect the larynx, nearly always secondary to pharyngeal involvement, practical points of difference in pathology, prognosis and treatment give ample reason for separating them and considering primary laryngeal phelgmon as a clinical entity. Up to the comparatively recent past, the non-inflammatory edema of the larynx which occurs in nephritis, cardiac affections, etc., has been grouped with erysipelas and phlegmon; now we not only distinguish a difference between those edemas and the edema of infectious, inflammatory nature, but we distinguish between non-inflammatory edema, as it occurs in cardiovascular diseases, and edema of angioneurotic nature, under which head may be placed those edemas which occur after the administration of kalium iodid.

The history of the development of our knowledge of these conditions may be divided into two periods: the prelaryngoscopic period, and the period since the discovery of that valuable instrument. Since Hippocrates, it has been regarded as "a good indication when erysipelas spread from within outward, and a bad sign when it spread from without inward." This retropulsion was studied more fully by later day writers, especially by Fabrizio D'Aquapendente, who presaged the theory of metastasis, but no especial mention is made of erysipelas of the pharynx or larynx until the eigtheenth century. Dareac observed and gave a fairly clear description of a fatal case of erysipelas of the pharynx which occurred during an epidemic of erysipelas in 1757. After an interval of more than a half century, Bayle, Bouillaud, Cruveilhier, Sestier, Radcliffe, Ryland, Porter, Mackenzie and others published observations which gradually established the separation of inflammatory edemas of the larynx and pharynx. In 1885, Massei published his reports of fourteen cases of primary erysipelas of the larynx, and three years later (1888) Senator published his contribution on "Acute Infectious Phlegmon of the Pharynx." Both of these observers were anticipated by other authors; for example, Massei by Cuire in 1864, and Porter in 1874, who observed a case of fatal primary erysipelas of the larynx at the London Hospital; Senator by Cruveilhier and Bergen; nevertheless, both papers mark milestones in the advancement of our knowledge of the subject. The controversy as to the phlegmonous process being identical with erysipelas of mucous membranes began with the discussion following Senator's paper, and has lasted to the present time.

Etiology.—In so far as both erysipelas and phlegmon are caused by streptococcus, they are identical (B. Fraenkel). Lately, however, there is a strong tendency on the part of bacteriologists to believe that there are different kinds of streptococci which are morphologically alike. It would seem as though this must be so when we consider the vast difference in the effects the various streptococci produce on the organism: in one case producing a localized abscess; in another a plastic inflammation of the submucous tissue with comparatively slight systemic manifestations, ending without the formation of pus in recovery; in another, infiltration, necrosis and suppuration accompanied by grave systemic symptoms, sweeping on irresistibly to death. Or does the dif-

ference in virulence depend upon the condition of the individual's cellular elements, or in the serum as manifested in the opsonic index? Future research must determine these matters. In all probability these micro-organisms are normally present in the buccopharyngeal cavity.

The portal of most frequent entrance in primary laryngeal phlegmon is the region of and about the epiglottis. Massei's experience leads him to regard the lingual tonsil as the most frequent point of entrance in laryngeal erysipelas. Not only is the epiglottis the point most exposed in the respiratory current, but on account of its prominence and position it is peculiarly subject to chemic, thermal and mechanical insults, incident to deglutition.

No age is exempt, an infant eleven months old and a woman of eighty years appearing in the reports of cases. As to sex, there is some doubt. Gerber collected thirty-three cases, presumably of acute laryngeal phlegmon (though he does not specify), in which twenty-three males and ten females were affected. Occupation bears a marked relationship to its etiology; those who come in contact with septic processes, such as nurses and patients confined to septic wards, are especially liable to acute infectious processes in the pharynx and larynx (Porter).

Pathology.—In the swelling caused by erysipelas of the larynx, cellular infiltration occurs to such a slight degree as to be relatively unimportant. In phlegmon, infiltration plays a most important role. In erysipelas, the cellular elements of the tissues remain intact. In phlegmon, from the very beginning of the process, necrosis is marked (Virchow). It is possible for the former process to pass into the latter and to have mixed forms (Bryson Delevan, Baruch, Henning and others). But this does not militate against the necessity of keeping the two separated because of practical clinical utility. Further, the edematous swelling of erysipelas may be readily resorbed and leave no lasting effect on the tissues. Tissues that are the seat of phlegmon, on the other hand, especially as it affects the larynx, are rarely restored to their integrity, but are replaced by scar tissue.

It is in the course of the two forms that dissimilarity is most marked. In erysipelas, the greatest danger is asphyxia. The systemic factors are relatively negligible, and if by intubation or tracheotomy the respiratory function can be main-

tained, a reasonable hope of recovery may be entertained.   In phlegmon, the systemic factors are by far the most dreadful, and in the majority of cases death from heart failure and pulmonary edema (sepsis) occurs before critical dyspnea appears.   The former remains a local disease, which affects the organism as a whole principally through the absorption of the toxins from the original nidus.   In the latter, septico-pyemic infection of trachea, bronchi, lungs, pleura, pericardium, spleen, kidneys, etc., is found on section to be the ruie.

Their initiatory symptoms are similar.   Both begin suddenly, frequently inaugurated by a chill, and followed by a high fever.   According to Gerhardt and Zeigler, a prodromal fever is characteristic for erysipelas, which occurs twelve hours before the subjective sensation and twenty-four hours before the objective appearances.   Dysphagia, which early becomes lancinating, appears, so that the patient expectorates the buccal secretions rather than swallow them.   The voice may or may not be quite hoarse or only clouded. Early dyspnea supervenes in erysipelas, often within a few hours.   Not so in phlegmon, which may proceed to a fatal issue without imminent danger of suffocation occurring.   On the other hand, the sensorium is more liable to be affected, somnolence, delirium.   In both, pain is caused by pressing on or moving the larynx.   The cervical lymph nodes are early involved, and swelling of the neck is more liable to be an early symptom in phlegmon.   Inspection of the pharynx in primary laryngeal phegmon gives no clue to the situation of the disease.   The mirror usually shows in erysipelas an epiglottis red, erect and glistening (Barnes), which may obscure the view of the rest of the larynx.   This same character of swelling extends to the aryepiglottic folds and false cords, but the interior of the larynx can rarely be seen.   In phlegmon, the laryngoscopic picture is quite different.   In the early stages it frequently presents the same appearance as early tuberculosis (Soka-lowski), and later may present the appearance of a ruptured dermoid cyst.   Here we have infiltration and the swelling is not so great.   In erysipelas, the swelling is much more marked in comparison to the duration of the disease, and is edematous.   In erysipelas, the color of the swelling is more of a livid bluish tone; that of phlegmon a waxy, pinkish gray.   The surface in erysipelas is smooth, glassy or glistening; in phleg-

mon dull, lustreless and minute'y roughened and flecked with mucopurulent discharge. The wandering character of erysipelas may produce fatal results by a downward course, invading the trachea, bronchi, pleura (Fulzer), or upward to the meninges, to the cranial cavity, causing fatal meningitis (Von Stein). Phlegmon does not so extend, but produces death in an entirely different manner (Von Feinsten).

The prognosis in phlegmon is extremely grave. It is difficult to accept Kuttner's optimistic belief that many cases recover which are not reported because the observers doubt their diagnosis. Certain it is that the great majority of phlegmons of larynx or pharynx end in death; the few that have recovered have done so after protracted suffering and grave intoxication.

The writer takes this opportunity of putting on record a typical case of primary laryngeal phlegmon, which he observed at Michael Reese Hospital in 1904.

Early in the morning of February 13th, I was called by Dr. Greensfelder to see Miss L., surgical nurse in charge of the operating room at Michael Reese Hospital. She had complained on the previous morning of a slight soreness in the throat on swallowing. The pharynx had been examined and, finding nothing visibly wrong, a simple gargle had been ordered, and the matter dismissed as unimportant. I wish to make this phase of the disease marked in order to impress the insidiousness with which this fatal disease may begin. About sixteen hours after her first complaint, I found a well-nourished woman, past forty, propped up by pillows in bed to a semirecumbent position. The expression of her face was not anxious but quite calm, except when she swallowed, when a grimace of pain spread over it. She expectorated the superabundant saliva rather than suffer the dysphagia. The voice was slightly clouded but not hoarse. The sensorium was not normal. The change in this regard might have escaped the observation of one not so well acquainted with the practical, matter-of-fact woman as ourselves. There was a certain nonchalance, a forced smiling, a casting of the eyes downward at the bedclothes, which she folded and picked. The temperature was 104, pulse 114, respiration 32. She complained of headache, pain in the throat, especially marked on the right side and made lancinating by deglutition. Examination of

the pharynx disclosed nothing but a chronic bilateral pharyngitis. She opened her mouth readily and freely.

Laryngoscopy.—The base of the tongue (lingual tonsils) was quite normal. On the right side of the epiglottis, beginning at the tip and extending along the edge to the aryepiglottic fold, was an infiltration of a dirty pinkish-gray color. The right false vocal band was very slightly swollen, but not markedly hyperemic. The mucosa of the entire larynx gave one the impression of grayish lividity, of being lustreless and minutely roughened; little flakes and streaks of muco-pus lay here and there. The vocal bands were silghtly hyperemic but not swollen. In fact, there was but little swelling anywhere; that on the epiglottis was very slightly elevated and disappeared imperceptibly into the surrounding tissue.

Later in the day the temperature dropped two degrees. Delirium and dysphagia increased. The infiltrations spread to the left side of the epiglottis, down the aryepiglottic fold to the vestibulum during the next twenty-four hours; then via the pharyngoepiglottic fold to the sinus pyriformis on either side. The view of the vocal cords was entirely cut off on the 17th of February, but symptoms of obstruction did not become marked until a few hours before death, which occurred at 11:05 A. M. on February 17th, so obviously from general sepsis and heart failure (pulmonary edema) that tracheotomy was deemed superfluous at a consultation of the attending surgeons of the hospital.

On February 16th the gland over the cricothyroid ligament became swollen. This corresponds with the extension of the process below the vocal cords, and tends to corroborate Poirier's (*Bull. Soc. Anat.*, 1887) researches on the region drained by these nodes.

The temperature ranged from 103 to 104, but with slight intermissions, when it fell once to 101. The pulse ranged from 100 to 140.

The delirium gradually passed into lethargy and this into complete unconsciousness long before the dyspnea became apparent. The urine was loaded with urates, but that passed during the first two days contained no sugar or albumin. Leucocyte count 24,000 on the second day. Cultures taken from the interior of the larynx at various times gave streptococcus in almost pure culture, whose morphologic and cultural char-

acteristics correspond with those of streptococcus pyogenes
aureus.

An autopsy was not permitted.

Treatment.—Those who come in contact with the sick, and
especially those who are much about pus cases, should habitu-
ally use a prophylactic mouth wash and gargle. This applies
peculiarly to nurses and internes, whose devotion to duty is
too often accompanied by insufficient out-door exercise and
fresh air, and renders them especially liable to throat infec-
tions. For this purpose I have been recommending for some
years past the following formula:

> R Acidi salicylici ....dr. iv
> Spts. ætheris nitrosi.....................
> Alcohol ....aa oz. .i
> Formalin . ...(1-10) oz. ss to oz. i
> Ol. caryophil ....dr. i
> Glycerine ....q. s. oz. iv

A half teaspoonful of this to a half glass of hot water is used
as a gargle and mouth wash whenever necessary.

The treatment of either erysipelas or phlegmon by injection
of antistreptococcus serum has been followed by results that,
to say the least, are disappointing. Our case of laryngeal
phlegmon received two injections, one twenty-four hours
from beginning of the disease, and one twenty-four hours
later, without in the slightest degree changing the local or gen-
eral conditions one way or the other.

Our treatment must therefore be symptomatic; thus we have
three principal indications: First, to combat the dyspnea;
second, to keep up strength and combat heart failure; third,
to assuage the dysphagia. In erysipelas the first indication
is most imperative; in phlegmon the second. Therefore, in
erysipelas we may be compelled to resort to tracheotomy or in-
tubation very early in the course of the disease. It should
never be put off, but when the laryngoscope discloses a dan-
gerous swelling, operative efforts to maintain respiration should
be decisively made. In the majority of cases of phlegmon
death occurred before dangerous dyspnea developed. Blebs
of the mucous membrane should be opened if they are situat-
ed in a position to interfere with respiration; otherwise, they
are unimportant and may be let alone. Whenever pus is
demonstrated, efforts should be made to liberate it at the earli-
est possible moment. Hot and cold applications to the neck

have been recommended. Massei is especially enthusiastic in the employment of cold. According to Paralowsjy's experiments, the employment of such cold applications tends to delay or arrest the multiplication and development of streptococci. It may be used externally in an ice bag, and small ice pills may be dissolved in the mouth. Bryson Delevan employed a spray of zinc chlorid and an alkaline solution of quinin, together with steam inhalations of antiseptics. Massei employs swabbing the throat with 1-2000 corrosive sublimate solution.

In our case adrenalin solution with and without cocain was employed with very slight effect on the distressing local sensations. The strength was kept up by rectal alimentation, the use of coffee and brandy and continuous rectal normal salt injections, and the hypodermic use of cardiac stimulants. Oxygen was employed toward the end when the first symptoms of dyspnea developed.

But in spite of all the patient died five days from the time she first complained of pain in the throat.

REFERENCES.

1. Hippocrates, Predict. I, iii.
2. d'Aquapendente, Opera Chemique Pars Prior lib. I chap. iii.
3. Küttner, Virchow Archiv. CXXXIX, p. 117, 1895.
4. Onodi, Arch. f. Laryngology, 1904.
5. Darluc, Jour. d. Med. et de Pharmac., July, 1757.
6. Bayle, Traitè de l'angina laryngée oedémateus, Paris, 1852.
7. Bouillaud, Recherches, Archiv. gen de Med. 1825, VII, etc.
8. Cruveilheir, Anat. path. des corps humain. I, lib. 5, pt. II, p. 1.
9. Sestier, Trait. de l'angina laryngée oedémateus. Paris, 1852.
10. Radcliff, Lancet, V. I, p. 536. 1835.
11. Ryland. Diseases and Injuries of the Larynx, London, 1837 p. 69-73.
12. Porter, Mackenzie's Diseases of the Throat and Nose, p. 147 (1880).
13. Mackenzie, Diseases of the Throat, Am. Edit.
14. Massei. Rev. clinica e terep. V. II, No. I, 1885.
15. Cuire, Thesis de Paris (De l'Erysip. du Pharynx) 1864, No. 136.

16.　Berger. Preussich. Verein, 1855.

17.　Senator. Berl. klin. Wochenschr., 1888, No. 5, p. 77.

18.　B. Fraenkel. Baumgarten Jahrbuch, Vol. V., p. 44.

19.　Gerber, Heymann's Handbuch, Vol. I, Part II, p. 1265.

20.　Virchow. Berl. klin. Wochenschr., 1888, No. 5, p. 80.

21.　Delevan. N. F. Med. Jour., 1885.

22.　Baruch. Berl. klin. Wochenschr. 1888, No. 13, S. 256.

23.　Henning. Chicago Med. Times, 1887, March.

24.　Gerhardt. Charite Annalen, Vol. XII, p. 208.

25.　Feigle, l. c., ibid.

26.　Sokolowski, Gaz. lek. 1888, Nos. 20, 21.

27.　Fulzer, Handbuch d. spec. Path. u. Therap. Vol. IV, p. 285.

28.　Paralowijy.

LXXVIII.

AN ORIGINAL RESEARCH ON THE CAUSE OF VOCAL NODULES.

BY F. E. MILLER, M. D.,

NEW YORK.

I desire to call attention to an entirely new theory of the formation of vocal nodules, based upon the personal observation of 234 cases occurring in my private practice. The facts herein mentioned are the results of further patient and persistent investigation of this subject, especially in consequence of many letters received from physicians and voice specialists, who have read my article on the same subject in the November, 1903, number of the *Laryngoscope*, and have requested further explanation of the cause of vocal nodules. With this object in view, I have had five original and very careful dissections or larynges made by Dr. Edgar E. Stewart and Mr. and Mrs. H. Howard Brown, voice anatomists of large experience, to whose skillful work under my direction this discovery is mainly due.

Summary. Of 234 cases of vocal nodules coming under my observation during the last fifteen years, 136 were found upon the left cord, 98 were on the right vocal cord. 32 were bilateral and symmetrical vocal nodules, that is to say, on the left side and right side at "C" sharp, that is at the anterior third of the cord, the most common place for nodules, two single nodules and two bilateral and symmetrical at "F" sharp in company with double bilateral "C" sharp nodules. The "F" sharp nodules were situated about half way between the thyroid end and the anterior third of the cord: One at "G" sharp, the remainder at "C" sharp. There was one "B" flat nodule on the left vocal cord and this was in company with a bilateral symmetrical "C" sharp nodule. This makes it very evident that these nodules occur at as many as four different points on the vocal cords, although the records of some investigators of this subject seem to allow for one only, and that always occurring at about the same point.

Before stating my theory of the origin of these nodules, I shall give the results of different kinds of treatment employed by me for their eradication. Prior to the year of 1902, I employed the ordinary medical means familiar to all. I found that such treatment was attendant with more or less indifferent success. Having been a public singer of recognized standing for a number of years, the pursuit of this subject was of especial interest to me. and while recognizing the fact that all nodules known upon the vocal cords did not occur in singers' throats, the systematic recurrence of nodules at specific points on the vocal cords, long ago led me to believe that the manner of voice use had something to do with this phenomenon.

During the year 1902 I met Mr. and Mrs. H. Howard Brown, the voice specialists whom I have already mentioned. They demonstrated to me a theory of voice action and a system of training which seemed to me to have a definiteness not present in the empirical system with which I have been familiar before. They assured me that in such cases of singers' nodules and vocal paralysis as I might have among my patients, there would be present certain vocal derangements, which, when removed, would better these conditions. Experimenting upon this, I sent them a number of people and the rapidity and certainty with which nodules and paralytic conditions disappeared were to me remarkable.

I herewith state the result of a few cases which were cured in this way.

Miss L. J. T., soprano with all the natural attributes for a magnificent singer: Voice out of commission. Double nodules cured in fourteen lessons. Reports made to me showed chin muscles much over-contracted, tongue badly depressed and tone consequently pinched. Remained with these teachers for some time and is now doing concert work, occupying position as dramatic soprano soloist in Temple Emanuel, one of the largest congregations in New York.

Miss E. P., soprano. Double nodules, tongue depressed, jaw pulled out of place, tone pinched, cured in thirteen lessons. Remained for one year, now in Berlin studying for grand opera with G. B. Lamperti.

Mrs. M. D., sporano in grand opera. Chin muscles over-contracted, voice pinched in high tones, nodule began to disappear in two lessons. Took ten lessons in all and returned

to opera singing. Assured us two years after that she had had no further trouble.

Miss G. R., principal soprano in Savage Grand Opera Co. Chin muscles over-contracted and tongue depressed, voice forced in high tones. Nodule on cord for four months, break in voice at "F" sharp. Nine lessons, without interfering with daily rehearsal; during the last part she sang four roles in one week. Voice then perfectly clear. The nodule was cured after the seventh lesson.

Mrs. J. T. O., soprano. Chin muscles over-contracted, voice totally paralyzed for singing effort. Fifteen lessons, sang concert in Providence, R. I., receiving good press notices.

Mr. E. W., noted concert tenor. Interarytenoid swelling for three years, tone husky, palate relaxed. Forty-seven lessons, great success in England. After a recent concert in Nashville, Tenn., paper styled him "The greatest tenor, by far, who has ever sung in Tennessee." Laryngeal condition perfect and tones perfectly clear.

In all of the above cases, in addition to vocal means, they used some Swedish massage movements on contracted chin muscles, believing that much good was accomplished by this means during the first stages of treatment. These movements aid in cure by relieving some of the worst muscular contraction and by stimulating circulation and nerve supply.

The general result of treatment of all these cases corresponds with the instances quoted above.

In the year 1903 I purchased an apparatus which, as used by me, has proven the sovereign remedy for nodes. This instrument completely supersedes the mechanical work above mentioned, and has more value in that it is an anesthetic and produces powerful desensitizing effects upon the mucous membranes, that border upon the marvelous. We know that a powerful blow behind the ear, upon the chest, back of the ear, or in the epigastrium, namely, over the principal vaso-motor ganglia, will shock the subject to which the blow is given, causing an anesthesia of that part, and a blanching of the mucous membrane within the nose and mouth similar to that produced by a sudden most serious hemorrhage. With an instrument which consists of a rubber cap screwed into a Swedish massage bulb fastened to a Vosberg's cable and a rapid motor operating this cable, anywhere from 1800 to 3000 revo-

lutions can be administered to the human body in the shape of blows accompanied by oscillation and suction.

By placing this instrument at a speed of 3000 revolutions per minute back of the ear and drawing it in the position of the stylo-pharyngeus from its mastoid attachment to the thyroid, then over the sterno-hyoid and sterno-thyroid, thence over the four layers of chin muscles, thence over the angles of the neck, then again from the occiput down along the spine along the vertical column to the os sacrum (the whole process not taking over two minutes), there will have been produced in the mucous membrane of the nose and throat most remarkable phenomena. A pallor will have spread all through the nares, posterior and interior, over the pharynx and into the larynx and particularly will mark the region of the epiglottis and larynx. Vocal cords with nodes upon them which are red and bulging and covered with mucus, will seem to be several shades paler. The cords themselves will be less bowed and the node will become surprisingly smaller and apparently absorbed to a great degree.

I know of no means that produces such quick and remarkable effects upon the mucous membranes of the vocal cords or upon these various parts mentioned above; so remarkable is this, that nodes, if quite acute, not too large and deeply infiltrated, will be absorbed in from three to five days. Of course, by singing again they are apt to recur, especially if the false mechanism is indulged in, or the reflex conditions established by the node-producing element have not been eradicated.

Observation, therefore, and recent experiments, lead me to believe that if these nodules of singers are to be permanently cured, the means of a correct vocal action must be resorted to in the majority of cases. Many people, not singers, produce nodes by coughing. I have seen a dog with nodes. But the nodes of singers which have caused so much discussion have been referred to by Prof. Turck, who first illustrated and called the attention of the profession to chorditis tuberosa acuta. Dr. Jas. P. MacAvoy, of this city, in his reminiscences of Prof. Schnitzler, of Vienna, says that he was accustomed to say to his post-graduate class of students from all parts of the world, "A guinea to the one that makes a correct diagnosis!" Although Dr. MacAvoy lived with Bergasse, Prof. Schnitzler's first assistant, for three years, he never saw the guinea carried away; he never saw a student able to make the diagnosis of a singer's

nodule or the acute chorditis of singers. It is no wonder then, that its diagnosis and etiology have been questioned.

The purpose of this article is to throw any additional light possible upon work which has already been done, and if issue is taken with any statements made by other voice specialists, it is for the purpose of furthering investigation by causing discussion of any points at issue, and in order that eventually we may arrive at the truth. That there must be cogent reasons for the affinity of the vocal nodule for certain portions of the cords, is certainly recognized by the most competent laryngologists, who have advanced many theories as to their cause, most of them mysteriously seductive, but not any of them definite enough to satisfy careful analysis.

In explaining this latest theory, it is necessary to understand something of voice action, and before stating my theory, and before giving the result of a microscopic examination of double nodes, which I removed from vocal cords, I will give a brief explanation of what I believe to be the correct standard for tone production. The fundamental movement consists of breath pressure. This production is caused by two movements, inspiratory and expiratory: The inspiratory movement consisting of exertion of the rib raising and expanding muscles, and contraction of the diaphragm. The expiratory movement consists of contraction of the abdominal and back muscles, which pull the ribs inward and downward. It is unnecessary for me to go into details any further than to say that it requires skillful work to establish a balance between the exertion of the expiratory movement, and the letting go of the inspiratory effort. The index of this breath control and pressure can be felt below the base of the breast bone, where it seems as though on contraction the rectus abdominis muscle bunches itself, giving apparently a forward movement. It has been known for a long time that in singing the scale of pitches, the thyroid cartilage tilts forward and the vocal cords are lengthened. We will designate this action as "cord stretching" for the purpose of lengthening and thinning the vocal cords as the scale ascends. This tilting is accomplished by means of the palato-pharyngei muscles which fasten to the upper back border of the thyroid cartilage, and on contraction pull towards their fixed end on the hard palate.

Attaching to the under side of the hyoid bone and on contraction pulling towards their fixed end at the top of the

breast bone, we have the sterno-hyoid muscles. The first of these pulls somewhat upward and forward at the back of the larynx, and the second pulls downward on the front of the larynx, causing a forward tilting of the thyroid cartilage. The vocal cords are fastened in the angle of the thyroid cartilage at their anterior ends and at their posterior ends to the arytenoid cartilage. It must be remembered that the arytenoid cartilages are attached to the cricoid cartilage, and do not move excepting to approximate the cords. In order that the larynx may have a fixed point upon which this tilting can take place, it is provided that the stylo-pharyngei muscles, fastening on the upper back edge of the thyroid cartilage and upon contraction pulling towards their fixed end at the styloid process, and the sterno-thyroid pulling from the side of the thyroid cartilage to the breast bone, combine to hold the larynx in place. I have watched the results of vocal work based upon this action, and have found them thoroughly satisfactory.

I herewith give microscopic examination of double nodes. The epithelial layer manifests no deviation from the normal, either in its external hornified stratum (which is very thin) or in its relation to the subepithelial connective tissue, in any portion of the sections examined. Except in one or two very small segments, the thickness is almost uniform throughout. Even with strong magnification (x460), not the slightest evidence of separation from the subepithelial layer can be noted. At a point corresponding to the apex of the nodule, there is a flask-shaped invagination, or crypt-like depression, about one-fifth the size of the total mass. This invagination begins as a tubular inversion which gradually enlarges to bulbous shape in the depth. In some of the sections this sacculation appears as an almost spherical closed cavity, which phenomenon, no doubt, is due to section above or below the level of the outlet to the epithelial surface. It could not be determined whether or not this was an artifact due to shrinkage in hardening of the tissue.

The connective tissue composing the bulk of the nodule is densest immediately beneath the epithelial layer, and gradually becomes more and more rarified as the base or attachment to the cord is approached. Throughout these portions the spaces formed by separation of the connective tissue fibres are infiltrated with a greater or less amount of homogeneous or very finely granular translucent substances, in every way resembling coagulated edematous (serous) fluid. Near the base or cord

attachment, the tissues are so loosely arranged that the fibrous fibrillae form a fine reticulum, the spaces of which are infiltrated with the translucent, homogeneous or firmly granular material. Here the tissue cells have assumed a marked stellate shape with decided prolongations, which anastomose with fibrillae from other cells of like nature to form this reticulum. This appearance is unquestionably due to edematous infiltration of a passive and very probably a chronic nature, since there is nowhere any evidence of cellular proliferation, except in the intima of the smallest vessels, which show a moderate degree of nuclear activity, but not sufficient to markedly encroach upon the lumina. No red blood corpuscles and but rarely a polynucleated leucocyte (wandering cell) were noted outside of the blood vessels.

Except for a slightly thicker horny layer of the epithelial covering, the nodule lowermost upon the pin presents the same histologic features.

Conclusions drawn from careful microscopic examinations made by Drs. Henry T. Brooks of the Post-Graduate School of Medicine, and John Larkin of the College of Physicians and Surgeons of New York, made especially for this article, show that in its simplest form the nodule is a superficial edema, manifesting itself on the edge of the vocal cord, sometimes appearing on one and then on the other, and at times on both, making symmetrical and bilateral nodules, dependent entirely on causation. For instance, the cause might be a simple case of coughing, and to simplify matters pathologically the nodule is an edema, a swelling from effusion of watery fluid in the cellular tissues beneath. If aggravated by continued use of the voice, it may develop and become exceedingly dangerous to the voice by extending outward to the tissues of the cord itself. The cure for this state of thing is by absorption of the fluid contents and a consequent diminution of the size of the nodule, until finally the condition of the cord becomes normal and the voice is fully restored. In the formation of the nodule, it is worth remarking that the traumatic or coughing nodule may appear at any point of the cord. It shows at first at one point and then at another. The nodule caused by vocal weakness, however, displays an exasperating, even puzzling affinity for particular portions of the vocal cords. It is generally found protruding from the anterior and middle third on one or the other side of the glottic opening. In fact, it frequently hap-

pens that the traumatic nodule and what for convenience's sake has been arbitrarily styled the "vocal node," are simultaneously present, the traumatic nodule existing by itself in some irregular portion of the cord or superimposed upon, or blended with the vocal node, each to be distinguished by its well defined location, although produced by totally different causes.

Those who would explain this by the theory of attrition or segmentation, would refer you to the stroboscope of Oertel, or possibly to the more or less familiar trick of the vibrating string and the bit of paper. If the paper be laid upon the string at a certain point it will be flirted away, while if it be laid upon the string at another point, the rest point, if you please, it will slip unagitated to the floor. Inasmuch as the vocal cords are subject to the same laws, the lesson drawn from the string and the bit of paper applies, the nodule taking the place of the paper. Note, however, the difference. The string is single and there is no attrition. If there were two strings, the bit of paper might be caught and sadily twisted in a miniature whirlwind of opposing vibrations, and a node produced symmetrically on its mate, the opposite cord.

By studying the laws of vibration of strings and pipes in physics, we find that there are sections of the vibrating string and portions of the air in the organ pipes which do not vibrate with the string or pipe as a whole, but which, as nodes and segments, subdivide the string and pipe into active and passive portions.

By careful observation we are able to see whether the vocal cords are making a segment in the center or whether they are vibrating longitudinally without making a segment with the opposite one by vibration. Dr. Curtis says: "As a matter of fact, the tiny pearls of mucus are driven by the centrifugal force of the vibrating vocal cords to the middle point of the vibrating segment and from thence are thrown outward. They mark, then, if anything, points of greatest movement in the vibrating segment, and not points of rest." Again, "This observation confirms the theory advanced several years ago by me as to the formation of nodules of attrition in singers' cords, and explains the removal of the same by exercises of vocalization."

There are those who define a "singer's nodule" as an inflammatory growth situated at the junction of the anterior and

middle thirds of the vocal cords, a definition which is certainly
most unsatisfactory when we know for a fact that nodes occur
between the middle of the anterior third and at the posterior
third, and also on both cords as well as at the junction of the
anterior and middle thirds. It has also been said that these
growths are due to the employment of an injurious method of
attacking tones, and are to be eliminated by using a "focus" of
tone a (a term certainly very hard to understand). This
"focus" of tone places the initial impulse upon the cords in
such a manner that attrition becomes impossible. I take issue
with this statement because I believe that attrition is not nec-
essary to form the nodule, as will be seen when I state my
theory. It may be after these growths have been started they
may be enlarged by attrition.

The defenders of the segmentation theory (portions of the
vocal cord being divided into parts), state that the damage to
the singing voice occurs in the upper medium register. What
is meant by this is probably the upper half of the middle reg-
ister, relatively high or low according to the voice, whether it
be soprano, contralto, tenor or bass. It is also said that this
segmentation is rearranged for higher pitches in such a man-
ner that the vocal cords do not rub against one another. On
the theory of the specific action of the thyro-arytenoideus ex-
ternus muscle that I now propose, this rather mysterious
statement is unnecessary. I also take issue with the following
statement: "That singers' nodules are the result of a direct
mechanical effect caused by the interference of opposite vibrat-
ing segments, and are not true nodes in an acoustic sense has
been proven beyond doubt by the investigation with the strobo-
scope of Oertel, Koschlakoff and Simanowski." Of course we
all have our own opinion, and having made some investigation,
we think that this is not proven beyond a doubt, and we do
not believe that it can be so for the one grand reason that
it is impossible to make proper observation with an instru-
ment which employs a human subject whose cords are to be
seen; again the eye and hand of the operator, and still further
an instrument whose revolutions are too rapid for the human
eye to make correct observation; and then again in all of these
observations we can see only the one side of the cord, that
being the upper side.

My theory on the causation of singers' nodes is as follows:
A great majority of the subjects present a follicular ton-

sillitis.   Accompanying this there is more or less congestion
of the mucous membrane in the larynx.   This renders that
portion over the vocal cords more liable to become edematous.
It is further thought that there is a hyperactivity of certain
fasciculi of the thyroarytenoideus externus muscle, and that
where these bundles cross the true cords there is produced a
localized edema or singer's node.

By a remarkable combination of circumstances, it has been
my privilege to have under my professional care all four of
the leading solo soprano voices of Old Trinity, St. George's
Church, Heavenly Rest and St. Thomas'.   These boys have
all begun their changes in voice under identically the same
conditions.   The boys I refer to are Earl Gulick, Allen Schneb-
be, Charles Mehan and Maxwell Kennedy, well-known boy
sopranos, who have sung all over the country.   The observa-
tion consisted of this: First, that it was the inflammation of
the left tonsil, then a partial paralysis of the left cord, then
the production of a node on the same cord at "C" sharp,
followed by the production of another node upon the other
cord.   In the left tonsil of each one of these cases were found
chronic follicular tonsillitis as determined by the usual signs
of this disease, one of which was the ability of the affected
tonsil to express large cheesy plugs.   In all these cases, be-
yond a slight inflammation of the anterior and posterior pil-
lars, there seemed to be nothing else to be observed about the
tonsil.   All of these little patients did not come to me for
sore throat, or because they were afflicted with tonsillitis, but
to consult me on their vocal debility and the loss of their sing-
ing voice.

One of them in particular went away with diagnosis of cheesy
deposits in the left tonsil and partial paralysis of the right
cord, with my request that he should not sing owing to an
impending change in his voice.   I did not treat this boy at
all, did not even spray his throat because I saw the nature
of his voice failure.   I merely expressed a few of the cheesy
deposits out of the tonsil crypts with the result that at that
service he sang well.   He returned to me, however, with a
node in his vocal cord produced in his attempt to sing "A"
at this service.   Going from the medium "E" to the high "A"
he felt a sudden giving away of his voice, although he was
able to hold the note almost to its end.   The following Sun-
day he was unable to sing, and although the boy returned

to me during the week, I did no more to his voice than to tell him that ι thought the change had begun. On the next Sunday his voice failed completely, so much so that the very remarkable statement was made by one of his musical friends to the effect that, while the first spraying of his throat had resulted in a decided relief from all his vocal debility and had put it in good order, the second spraying had brought about a condition that had ruined his voice. Subsequently, at his father's suggestion, the boy resigned his position. In reality I had not used the spray at all, and did not treat him the second time. Since that time he has not sung at all, his voice having descended an octave without treatment, except for tne treatment of the ear on the same side with the inflamed tonsil, and which has been affected a long time in consequence of the diseased tonsils through the auricular branch of the vidian. Undoubtedly, this had also affected the nerve supply of the ear and had created certain catarrhal disturbances affecting that ear seriously. As a result his voice has completely changed and is now in that broken condition that usually follows the change of' boys' voices always noted at puberty. The node, however, has entirely disappeared and so has the paralysis of the cord, while in singing the usual phenomenon takes place, although he is now 14 years of age. Should he sing from "A" flat down to "C", his voice would immediately break at "C" sharp and jump a fifth, that is, to the "G" sharp below, either going into the man's voice or giving out entirely. Now in singing his voice jumps the entire octave from "C" sharp down to the lower "C" sharp on almost every occasion, and, strange as it may seem, all of these boys have had exactly the same phenomena.

If we turn to the thyroarytenoideus externus muscle, we will see that its action is somewhat complicated on account of its attachments.

A brief description of the anatomic conditions existing in this portion of the human larynx would seem appropriate here. The thyroarytenoideus internus extends horizontally backwards from the inner surface of the thyroid cartilage in front, near the median line, to the muscular process of the arytenoid cartilage behind on either side, and forms the inferior or true vocal cords. Externally or laterally, but still within the confines of the thyroid cartilage, this muscle is overlapped by the thyroarytenoideus externus or wall muscle, whose fibres run

almost vertically upward from the anterior inferior part of
the inner surface of each ala of the thyroid cartilage, from its
lower border in front, and also from the anterolateral portion
of the inner aspect of the cricothyroid membrane to spread
out in the mucous membrane of the larynx above, and is
inserted in part into the edge of the epiglottis. Thus it will
be seen that these muscles cross nearly at right angles, some-
what in the manner represented in the diagram. It is just at
the site of contact of these two muscles on the mucous mem-
brane where the vocal nodes occur. From Luschka's draw-
ing, it will be seen that there are practically three divisions
of this muscle: the arytenoid division which unites with
the cricoid, the thyroid division, and the epiglottic division.
The action of this muscle plays a most important part in the
approximation of the vocal cords, and as normal intrinsic
action is dependent upon normal extrinsic action, it will read-
ily be seen that any derangement of the external action would
cause a direct tendency of this thyroarytenoideus externus
muscle to overact, and it is upon the combination of those
tonsillar lesions and the overaction of this muscle that my
theory is based.

With regard to prevention of nodes, if in childhood aden-
oids and tonsils receive their proper attention, if lingual
tonsils and pharyngeal hypertrophies are watched with care
and removed; if children are made to be very careful dur-
ing the period of voice change, menstrual functions and other
conditions which cause sympathetic nervous changes to take
place affecting the mucous membranes at the age of puberty;
if a correct synthetic voice production or voice science be es-
tablished, which can be simplified and studied by proper ana-
tomic and physiologic laws, we probably would never have
the nodule question to consider except as a matter of acci-
dent.

Acting upon this theory, I have caused some dissections to
be made with the inference that there must be some factor
at work beneath the mucous membrane over the cords which
cause a local edema and consequently the slight elevations
which appear. The idea was conceived that the venous re-
turn might be cut off by the pressure of certain muscles act-
ing in different directions and thus cause the local swelling.

Case I. Larynx of a Chinaman, aged about 45. Occupa-
tion, laundryman. Voice high pitched, larynx large. Found

thyroid fasciculus large; cricothyroid fasciculus also large, but a space between these fasciculi where the muscle was very thin. Arytenoid fasciculus broad and thin. There were no nodes on these cords. The larynx was a beautiful specimen, but the tonsils were in their normal condition.

Case II. Larynx of a negro, aged 24. Occupation, waiter. Voice gutteral, specimen large, cords lax. The anterior fasciculus was larger, broader and stronger than in the former specimen, but the cricothyroid bundle was not as distinct. The space between these fasciculi was better filled with muscular tissue. No nodes existed. Tonsils normal.

Case III. Larynx of a white girl, aged 18. Occupation, unknown. Character of voice not known. Larynx, fair size. Thyroarytenoideus externus well developed, especially its posterior portions, that is, those arising from the cricothyroid membrane and from arytenoid. No nodes present. Tonsils normal.

Case IV. Larynx of a butcher, aged 45. Specimen of medium size. Character of voice not known. In this instance the thyroarytenoideus externus was more peculiarly sloped, the lower part extending mostly from the thyroid cartilage. Was quite thick and broad for about one-half its course. The upper end, while not entirely lacking, was very poorly developed. For this muscle, there was no fasciculus more distinct than another. Pharyngeal tonsils normal. No nodes present.

Case V. Larynx of a laboring man, aged 40. Specimen of large size. Character of voice unknown. This larynx resembled the previous one in all particulars, except that the upper fibres of the thyroarytenoideus externus were more distinct.

Case VI. Male larynx, aged about 35-40. History unknown. Very large. Thyroarytenoideus well developed, especially the arytenoid fasciculus. The muscle was unusually thick where it overlapped the cord. No nodes were present. Tonsils not enlarged.

After procuring these photographs of this muscle, I recently had the following experiments made to try to produce a node:

A medium-sized dog was examined to see if he had any nodes on the vocal cords. None were found. His larynx was then operated on, using the modern surgical asepsis with the idea of producing nodes. The anterior inferior angle of

one ala of the thyroid was trephined (3-8 inch trephine) and a mattress suture taken in the thyroid fasciculus of the wall muscle. The parts were then closed. The dog was allowed to live two weeks, means being taken to cause him to bark considerably during this time. He was then chloroformed, the larynx taken out and the following observations made: Skin wound healed by first intention; parts beneath in beautiful condition; muscle shortened considerably. No nodes were found.

This would hardly disprove the theory, as the tonsils were not in the typical condition observed by me.

Another experiment: A fairly good sized shepherd dog was used. In order to produce a tonsillar inflammation in the animal, a plug of debris was expressed from tonsils of two renowned singers having nodes, one male, the other female, and rubbed with considerable pressure into the mucous membrane between the pillars of the fauces while the dog was anesthetized. This was done within eight hours after removal from singers' throats. On inspecting the throat every day for a week, no change was noticed.

Several factors were supposed to account for this. First, the bacteria contained in the tonsillar plug from the human pharynx were thought to be of too low a virulence. Second, the resistance of the mucous membrane without any previous congestion was thought to be too high. Third, several errors in technic were discovered which probably played a lesser part.

These several indications were met in the following ways:

The resistance of the tonsils and mucous membrane was lowered by painting the region with cantharidal collodion while the dog was anesthetized. This produced a typical congestion and in a couple of days a young and virulent culture of pure streptococci was rubbed on the inflamed parts. No false membrane formed but a true tonsillitis developed. After a few days the dog was prepared for operation (neck shaved and all aseptic precautions taken). The skin incised in the median line, one ala of the left thyroid cartilage exposed. This was treated in the following manner: A slit-like opening was made in its lower part about 3-16 of an inch in width and almost as long as the entire width of one ala. The piece of cartilage was removed and the thyroarytenoideus externus lifted into the gap. From its central portion a piece was re-

moved consisting of the entire thickness but not completely
dividing the muscle, leaving the anterior and posterior por-
tions in the hope that nodes would be produced at the joints
where these fasciculi pressed on the true cord. The vacancy
in the cartilage was then packed with a gauze drain and the
latter carried to the surface. The skin was sutured and a
dressing 1-100 formalin was used. Convalescence was un-
eventful, except that it was noticed that the dog's bark had
changed.

The cords were examined with a laryngoscope and a node
was noticed about where the posterior fasciculus crossed the
cord. The dog was shortly afterwards chloroformed and the
larynx and tongue were removed. A node was observed on
the posterior portion of the left cord. The larynx was then
placed in a weak solution of formalin and the node became
smaller. On splitting the larynx open from behind through
the cricoid cartilage, the node disappeared. From this it is
suggested that nodes cannot be preserved after death.

We have under way several experiments of like nature, by
which we hope to prove that nodes can be produced in every
case by means of infection of the tonsils and perverting the
action on the thyroarytenoideus externus muscle. We hope
to have the pleasure of demonstrating the successful outcome
of these experiments at some future date.

In closing the discussion of this article, I desire to give
credit to all of our professional brethren who have done val-
uable service in the treatment of singers' nodules.

We admit that our system is not the only method of cure,
but we claim that if this system is followed, it will be further
reaching than temporary cures, that if given a reasonable
length of time, it will tend towards a great lessening of this
evil with a possibility of its eradication.

By combining our efforts we, the throat specialists of the
world, might become largely instrumental in helping singers
and singing teachers to cast aside forever empirical methods,
and accomplish the development of the only true thing, a
synthetic method. Although the main purpose of this article
seems to be the establishment of the origin of nodes, I should
feel highly gratified if the ultimate outcome of it should be
their prevention.

I, therefore, close this article and its discussion by laying especial emphasis upon the clause relating to prevention. I extend sincere thanks to those who have aided me in the preparation of this article, and to all the gentlemen here present for their courteous attention during the delivery of it.

LXXIX.

CARCINOMA OF THE LARYNX—OPERATION AND SPECIMEN.

By Charles W. Richardson, M. D.,

PROFESSOR OF LARYNGOLOGY AND OTOLOGY, GEORGE WASHING-
TON UNIVERSITY,

WASHINGTON.

On the sixteenth of January, a gentleman, 72 years of age, was brought to me for examination. He had been continuously hoarse for a period of six months. Previous to this hoarseness, there were six months in which the voice had been altered from time to time. The voice was raw, presenting the voice characteristics of a tuberculosis. The patient's general history was most excellent.

Present status: Apparently a strong, healthy man, of medium height, well nourished, slight pallor of the skin, nervous and excitable. Examination of the neck externally showed no enlarged glands; nose and pharynx normal. Examination of the larynx showed a growth involving and affecting the anterior two-thirds of the left vocal cord, and extending slightly and apparently beyond the commissure to the other side. It was interesting to note that this patient never complained of spontaneous pain or any painful sensations after talking. Diagnosis was made of cancer of the larynx and the patient so informed. Procedure to be adopted was left open to the patient, he being told of the various methods of treatment. After about three days he decided that he would have the growth removed, and all arrangements were made to do a partial or complete laryngectomy, according as the condition required. On February 4th the operation, which necessitated about two and one-half hours of actual time employed, was done. The patient was placed in the partial Trendelenberg position and no preliminary tracheotomy was done. A single excision, extending from the hyoid bone to within one-half inch of the sternum, was employed; no transverse cuts were made. Great care and precision were observed in the

operation, all vessels being tied before being severed, and there
was practically no hemorrhage. When the larynx was ex-
posed, it was found to be almost completely calcified. The
box of the larynx was split open and the growth examined.
As the condition extended well over to the left side, it was
thought best to do a complete laryngectomy and give the
patient the opportunity of recovery, with the hope of no pos-
sible recurrence. The trachea was divided at the first ring,
brought out of the opening and stitched to the skin. The
larynx was then leisurely removed from its position. A good
flap was obtained from above and the pharynx thoroughly
closed off from the wound cavity. An iodoform wick was
inserted in the wound and the lips of the wound brought
together thoughout, except where the wick projected above
and below. The wound was dressed as usual and the patient
sent to his room. Reaction was good, temperature not go-
ing above 99° during the first twenty-four hours. The second
day there was quite a sharp reaction, temperature running
up to 102 2-5° ; from that time it remained between 99° and
101°, until the termination of the illness. Respiration
remained - between 20 to 26 until the morning of the
patient's death, when it ran up very rapidly. Pulse,
lowest, was 77 and never reached above 128 until the morn-
ing of the patient's death. The condition of the wound was
perfect throughout, only a little hemorrhagic oozing once or
twice during the post-operation period. The patient was in
good spirits throughout except the night before his death,
when he became delirious, though not constantly so. On the
fourth day food was taken freely, with no leakage in the
wound, showing that there was complete closure of the
pharynx from the wound cavity. The patient died on the
morning of the fifth day in collapse. As no post-mortem was
made, the condition which gave rise to the sudden termina-
tion can only be surmised ; in all probability, it was cardiac
exhaustion. There was very little secretion about the tra-
cheal opening at any time during the operation. The dress-
ing over the tracheal opening did not become very moist. The
case seemed a most favorable one until the evening of the
fourth day.

Remarks.—The most imporant question in these cases
is, "Are they or are they not operable?" Although I was
rather disinclined to do anything in this case, it seemed one

of the most promising I had ever seen. The growth was localized, entirely intrinsic and extensive; there were no glandular infiltrations, and everything about the patient's neck seemed to promise a most successful issue in case the operation was made. He was anxious to be operated upon and anxious to get well. The operation was done with all due caution and careful technic; so, even in a case that might seem to offer every advantage from its character, the condition of the patient and the surrounding circumstances did not have a favorable outcome. To my mind it seems that complete laryngectomy does not offer a very favorable result in the aged. The violence is very great and it requires a strong, middle life to withstand the shock attendant upon such an operation. Of course, the question of a lesser operation enters into the plea also, for example, partial laryngectomy, done along the lines suggested by Sir Felix Semon, in which there is a partial excision, where there is a removal of the hard and soft parts of the larynx beyond the area of diseased tissues, and the operation which was narrated to me by Dr. J. Solis-Cohen, which consisted of stripping the perichondrium from the inner surface of the chondrium, thus removing the perichondrium, mucous membrane and growth en masse. To me it seems that this latter operation is one that offers great advantage, in case one could be assured that there was no involvement of the chondrium.

THE CLINICAL ANATOMY OF THE TONSIL.*

BY WILLIAM LINCOLN BALLENGER, M. D.,

PROFESSOR OF OTOLOGY, LARYNGOLOGY AND RHINOLOGY, COL-
LEGE OF PHYSICIANS AND SURGEONS,

CHICAGO.

The tonsil (Fig. 1) is situated in the sinus tonsillaris be-
tween the faucial pillars and has its origin in an invagina-
tion of the hypoblast at this point. Later the depression thus
formed is subdivided into several compartments which become
the permanent crypts of the tonsil. Lymphoid tissue is de-
posited around the crypts, and thus the tonsillar mass is built
up. The inner or exposed surface, including the cryptic de-
pressions, is covered with mucous membrane, while the outer
or hidden surface is covered by a fibrous capsule.

It will be observed that the tonsil is an encapsulated organ,
and that it is characterized by eight to twenty crypts or tubu-
lar depressions. Many practitioners have confused the tonsil
with the follicular tissue immediately surrounding it. So
long as they were able to remove follicular tissue through the
wound in the sinus tonsillaris, they thought they were remov-
ing tonsillar tissue. In this they were mistaken, as the
lymphoid tissue immediately surrounding the tonsil is not en-
capsulated, nor is it characterized by cryptic depressions.

The tonsil does not always completely fill the sinus ton-
sillaris, the unoccupied space above it being known as the
supratonsillar fossa, into which several crypts usually open.

The outer aspect of the tonsil· is loosely attached to the
superior constrictor muscle of the pharynx, thus subjecting it
to compression with every act of deglutition. The palato-
glossus and palatopharyngeus muscles of the pillars also com-
press the tonsil. Grober cites authorities who claim that the
compression of the muscles force food and bacteria into the
crypts.

*Candidate's Thesis for Fellowship in the American Laryngo-
logical Association, Niagara Falls, May, 1906.

The Crypts.—The crypts are usually tubular and almost invariably extend the entire depth of the tonsil to the capsule on its outer surface. Some, however, are compound, i. e., they divide below the surface into two or more tubules. They are usually comparatively straight, though they may be tortuous in their course. I have examined many tonsils removed with the capsule intact, and have rarely found crypts that did not extend through the follicular tissue to the capsule. Those opening in the supratonsillar fossa usually extend downward and outward, whereas in the lower portion of the tonsil their direction is outward. The area occupied by the mouths of the supratonsillar crypts constitutes, according to Killian, the hilus of the tonsil. Clinically, the crypts seem to be the source of the greatest amount of local and constitutional disturbances, as they often become filled with food, tissue debris and bacteria. This is especially true of those capped over by an overlying membrane, as in the supratonsillar space, and the anteroinferior portion of the tonsil which is covered by the plica triangularis. The plica supratonsillaris (Fig. 1) does not, in all cases, enfold the hilus, or supratonsillar crypts, as the tonsil often fails to fill the supratonsillar space. In other instances it closely hugs the upper end of the tonsil, thereby completely closing the mouths of the crypts. It is in these cases, particularly, that the contents of the crypts are retained. This is also true in reference to those covered by the plica triangularis.

Reasoning from a mechanical point of view, one would reach the conclusion that the retention of the infected secretions must necessarily give rise to infectious inflammatory processes. Clinically, we know that this is not true. The crypts are often found filled with food, tissue debris and pathogenic bacteria, without any appreciable inflammatory reaction. Nevertheless, as I shall exemplify later, the mechanical closure of the crypts by the plica supratonsillaris and the plica triangularis adds greatly to the tendency to inflammatory and other morbid local and general processes.

It may be stated as a general law in physiologic pathology that mechanical obstruction to the drainage of any secreting cavity tends to result in local morbid processes and in toxic or infectious manifestations in remote parts of the body.

The Epithelium.—The free surface of the tonsil, including the crypts, is covered with stratified pavement epithelium, the

deeper layers of which are columnar in type, while the superficial are pavement. Goodale has shown that certain coloring matter when dusted in the crypts is readily absorbed into the interior of the tonsil. He claims that the absorption probably takes place through the interspaces between the cells. From this, the inference might be made that bacteria are absorbed with equal facility. This conclusion does not, however, coincide with either physiologic or clinical data.

Jonathan Wright has shown that there is a vast difference in the absorptive power of the tonsil for dust and for bacteria. He dusted in the crypts of the tonsil carmine powder and bacteria and excised it fifteen minutes later. The microscope showed the carmine particles in great abundance beneath the epithelium and within the intercellular spaces, whereas, no bacteria were found. He also observed that the carmine dust remaining on the outside of the tonsil was easily washed away, while the bacteria were more difficult to remove. The adherence of the bacteria to the live animal membrane and their failure to pass through it, he ascribed to the viscosity of the bacteria, a biomechanical property of microorganisms. The mechanical affinity existing between the bacteria and a living mucous membrane, he considered as one of their defensive and offensive properties of a biomechanical kind, as distinguished from their biochemical products, the toxin and endotoxin. Dust or carmine powder does not possess this adhesive property, hence it is readily absorbed, whereas the bacteria are not.

We know, however, from abundant clinical experience that there are conditions under which the bacteria are absorbed through the cryptic epithelium in sufficient numbers to excite marked local and constitutional disturbances. Apparently the adhesive property of the bacteria has been overcome, or the toxin of the microorganisms within the crypts has converted the live epithelium into inert matter, through which it readily passes. Wright again says "from the experiments of Goodale and others with colored granules, from my own observations of dust particles passing the epithelial layer in health, and bacteria passing it in diseases, it is evidence enough that there must be something beyond mechanical obstruction, which, under ordinary conditions of health, keeps the tissue beneath the epithelium free of bacterial life which swarms in some of the crypts on the outer side of the epithelial cells.

Hitherto the revelations of the antitoxic power of the blood sera have been insufficient to explain the problem. That explains the nullification of the toxic power of the pathogenic germ, after it passes within the tissues, but it does not explain immunity from infection—to translate literally, the freedom from the carrying in of the germ. It seems probable from experimentation with various forms of protoplasm that the animal organism evolves defensive properties to destroy by lysis, when the system through lack of excretory power becomes embarrassed by their presence."

Wright further says that "bacterial protoplasms may excite bacteriolytic ferments in the epithelial cells, a property heretofore referred by Metchnikoff to the leucocytes only." In these ways he attempts to show equilibrium existing between immunity and infection. An imbalance of this equilibrium is effected by a loss of local tonicity or health, and infection then takes place.

In the epithelial lining of the crypts we find, therefore, the following properties:

a. A biomechanical resistance to the invasion of the microorganisms, viscosity.

b. A biochemical destruction or taming of the microorganism in the crypts through the agency of a ferment thrown out by the epithelium under the stimulus of the retained bacteria. This process is known as bacteriolysis.

So long as the epithelium of the crypts is in a state of tonicity or health, an equilibrium between immunity and infection is maintained. When the cellular tonicity is impaired, the equilibrium between immunity and infection is lost and infection occurs. When the crypts are closed by the plica supratonsillaris and plica triangularis, or by concretions in the mouths of the crypts, a very active warfare between the retained microorganisms and the epithelial cells is begun. The cells throw out a poisonous ferment, whereas the bacteria throw off a toxin for the purpose of impairing the tonicity of the epithelium. If the siege is continued sufficiently long, the cells give way and the infectious host penetrates the epithelial barrier and enters the deeper tissues of the tonsil.

The Sinus Tonsillaris.—The anterior pillar contains the palatoglossus muscle and forms the anterior boundary, whereas the posterior pillar contains the palatopharygeus muscle, and forms the posterior boundary of the sinus. The pillars meet

above to unite with the soft palate. Inferiorly they diverge
and enter into the tissues at the base of the tongue and the
lateral wall of the pharynx respectively. The outer wall of
the sinus tonsillaris is composed of the superior constrictor
muscle of the pharynx. The sinus tonsillaris is, therefore, a
triangular depression on the lateral wall of the fauces which
partially envelops the tonsil.

In so far as my clinical observations show, the tonsil is
loosely attached to the sinus, that is, the so-called adhesions
are not present. The extent of the attachment varies in dif-
ferent subjects. Patterson has shown that the supratonsillar
fossa may extend downward so as to admit a bent probe be-
tween the outer side of the tonsil and the superior constrictor
muscle of the pharynx, as far as the inner surface of the lower
jaw. Even where the attachment is general it is not usually
so firm as to greatly interfere with the enucleation of the ton-
sil. The "adhesion" to the anterior pillar so often spoken of,
is, in my opinion, a myth. It is true that the tonsil has an
anatomic connection with the anterior pillar, but the union
is not of that firm fibrous nature usually implied by the term.
Indeed, the "adhesion" often undoubtedly refers to the pres-
ence of the plica triangularis which covers the anteroinferior
portion of the tonsil, and which is often attached to the tonsil
at its inferior extremity. One writer even speaks of the plica
triangularis as an hypertrophy of the anterior pillar, whereas
in fact it is an embryologic structure, which in some of the
lower animals develops into the tonsil itself.

The anterior limit of the sinus tonsillaris often extends well
under the anterior pillar, thus concealing a large portion of
the tonsil. The outline of the tonsil may readily be determined
by digital examination or by seizing it with forceps and draw-
ing it towards the median line of the throat. When thus
drawn the anterior shoulder of the tonsil may be seen outlined
beneath the anterior pillar, and if still more forcibly drawn
inward, the tonsil mass slips from beneath the pillar, thus
showing that it is not markedly adherent, but that, on the con-
trary, it is loosely attached and by proper procedure may be
readily enucleated.

The Lymphatics.—The relation of the tonsil to the lymph-
atic vessels is somewhat different from that existing between
the lymphatic gland and vessels. The difference in the relation-
ship consists in the fact that the lymphatic vessels have their

origin in the tonsil, whereas they pass through the lymphatic gland. The question of chief clinical importance is the course and termination of the tonsillar lymphatic vessels which drain into the deep cervical chain underneath the sternocleidomastoid muscle, and, from thence, to the thoracic glands and finally into the thoracic duct. By this route, infection is carried to all parts of the body. The tonsil, under certain conditions, being peculiarly susceptible to infection, becomes, therefore, the atrium of infection for a great variety of diseases extraneous to itself. The literature is rich with clinical reports of diseases illustrating this fact.

In reference to the tonsil as the portal of infection in tuberculous processes, it is pretty generally admitted that it often takes place through the tonsil and extends from thence through the lymphatics of the deep cervical chain on into the thorax. It then passes through the hilus of the lung into the visceral pulmonary lymphatics. The apex of the right lung is the most frequent seat for the inception of the pulmonary tuberculous disease. This has, heretofore, been attributed to the fact that this area is less directly in line with the respiratory air current, and that this portion of the lung has less motion than other portions of either lung. It forms, therefore, a peculiarly favorable location for the development of the tubercle bacillus.

Dr. J. Grober has called this route of pulmonary infection into question, or at least he has set up a rival hypothetical explanation, based upon a series of experiments upon lower animals. He reports the following three suggestive experiments out of a total of twenty-eight:

First experiment, September 16, 1902. A young rabbit was anesthetized by ether and chloroformed, and 1 ccm. of a sterilized emulsion of black Chinese paint injected into the left tonsil.

September 23, 1902, the autopsy showed black particles in the blood. Behind the left tonsil there was a mass compound of the coloring matter and leucocytes. The lymph glands on left side of the neck, as far as the upper border of the thyroid cartilage, were stained black. The microscope demonstrated the lymph vessels filled with free coloring matter, as well as leucocytes which enclosed small particles of pigment.

The glands and lymph vessels were fairly packed with the

coloring matter. Beyond the zone of the lymph glands and vessels little coloring matter was found.

Second experiment. A small dog was narcotized by morphin injections. Six and one-half ccm. of the sterilized emulsion of black pigment was injected into the tonsil.

The autopsy, after complete exsanguination, showed the following conditions: very little coloring matter in the leucocytes, none being free in the blood. The tonsil and the loose connective tissue containing the afferent lymphatic vessels of the tonsil were of a deep black color.

Along the muscles of the neck, as far as the hyoid bone and to the median line, there were streaks of pigment. The pigmented area also spread downward below the hyoid bone, where it extended 1 cm. beyond the median line. The coloring matter was traced to the bony opening of the thorax and to the parietal pleura, which, when stripped off and examined by transmitted light, showed the black pigmentation. The lymph vessels of the paratracheal connective tissue, and of the esophagus as far as 2 or 3 ccm. above the bifurcation of the trachea, were also colored, whereas, on the left or uninjected side, no such phenomenon was found. All the lymph glands on the lateral wall of the pharynx, hyoid bone, larynx, along the deep vessels of the neck and supraclavicular fossa on the right side were black. The parietal pleura at the apex showed an exudate but no adhesion to the visceral pleura.

The microscope showed that in all the above mentioned positions there were no other changes present. In the glands the coloring matter occupied the paravascular spaces. In the lymph vessels between the supraclavicular glands and the parietal pleura of the apex, there were a large number of leucocytes filled with coloring matter. Free coloring matter was also present in this region. In the apex of the lung there were no signs of an inflammatory reaction. The coloring matter here seemed to be freely deposited within the connective tissue. In the above mentioned exudate at the apex, there was coloring matter in the leucocytes.

Third experiment, April 4, 1903. A small dog was placed under morphin narcosis and 5 ccm. of coloring matter injected into the tonsil. April 13th the same experiment was performed on the opposite side.

May 10th the autopsy, after exsanguination, showed a large amount of coloring matter free in the blood; the leu-

cocytes, the tonsil and connective tissue, and the connective tissue of the neck on both sides along the larynx to the aperture of the thorax were colored symmetrically. The lymphatic glands along the large blood vessels as well as those in the supraclavicular region were deeply stained. The coloring matter was also found within the lymphatic vessels and in the paravascular spaces. A fibrous exudate was found in the apices of both lungs, thus forming a bridge of inflammatory material from the parietal to the visceral pleura. The coloring matter was also present in the exudate. The microscopic appearance of the apices presented a light greyish coloration. The glands in the mediastinum were stained on the left side, as were also the bronchial glands. In the left lung there were three other small fibrinous exudates in which the coloring matter was present.

From these experiments Grober builds the hypothesis that tubercular infection of the apex of the lung may take place via the deep lymphatic chain, the supraclavicular glands and thence to the parietal lymphatic vessels, where an inflammatory exudate is thrown across to the visceral pleura. The tubercle bacilli travel across this inflammatory bridge and enter the apex of the lung.

While these experiments are not conclusive they are interesting and open a field for further observations.

The Blood Supply.—The tonsillar artery, a branch of the facial, is the chief vessel to the tonsil, though the ascending palatine, another branch of the lingual, sometimes takes its place. The tonsillar artery passes upwards on the outer side of the superior constrictor muscle, through which it passes and gives off branches to the tonsil and soft palate. The palatine, another branch of the lingual, also sends branches through the superior constrictor muscle to the tonsil. The ascending pharyngeal also passes upwards outside of the superior constrictor, and when the ascending palatine artery is small, it gives off a tonsillar branch which is correspondingly larger. The dorsalis linguae, a branch of the lingual artery, ascends to the base of the tongue and sends branches to the nostril and pillars of the fauces. The ascending or posterior palatine artery, a branch of the interior maxillary, supplies the tonsil and soft palate from above, forming anastomoses with the ascending

palatine. The small meningeal artery sends more branches to the tonsil though it is of minor importance.

CLINICAL APPLICATION.

Without reviewing the literature, which is rich in reports of cases showing the tonsil to be the portal of infection for many diseases in remote parts of the body, I have attempted to show under what conditions it becomes the portal or atrium of infection. Under conditions of local equilibrium or health of the epithelium lining the tonsillar crypts, infection does not take place, whereas, when the local equilibrium is lost, infection occurs. That the local equilibrium of the cryptic epithelium is frequently lost is apparent to every clinician. In addition to the diseases arising through the tonsil as a portal of infection, there are those limited to, or having their focal center in the tonsil itself. Perhaps the strongest indictment against the tonsil is that it is often the atrium of infection in pulmonary tuberculosis. Whether the route of infection is via the deep lymphatics and the hilus of the lung, or the deep lymphatics and the parietal pluera at the apex, as shown by analogy in the experiments of Grober, is immaterial in so far as the general question is concerned. The question of prime importance is, do pulmonary or other types of tuberculosis have their origin through the tonsil as a portal of infection? In view of my own observations, and of others, I must answer in the affirmative. Just what percentage, has not been fully determined. Various writers report from four to ten per cent of tonsils removed as showing local tubercular lesions, as tubercle bacilli and giant cells.

The structures of the tonsil which seem to favor infections are the deep crypts, especially those in the supratonsillar fossa and those covered by the plica triangularis. Wright has suggested that the imperfect drainage of the crypt leads to the ultimate loss of tonicity (equilibrium) in the epithelial cells lining them, thereby opening the way to systemic infection through the tonsil.

The question naturally presented at this juncture is, what is the rational method of procedure to protect the system from further infection. The choice of remedial measures seems to lie between internal medication, local applications, and surgical interference.

As to the first and second methods of treatment, it may be said that there are cases which may be satisfactorily treated by them, especially in relieving the distressing local inflammatory symptoms; indeed many cases may be practically cured by such treatment. There are many others, however, in which such measures are wholly inadequate, either to relieve immediate symptoms or to ward off future attacks. In these cases, we have usually resorted to some surgical procedure, such as opening the crypts, plunging the cautery point obliquely across them, decapitation (partial removal of the tonsil), and the complete removal of the tonsil.

The literature shows a wide divergence of opinion as to what constitutes the best method of surgical treatment, though it shows nearly all writers as being practically agreed that some sort of surgical procedure is indicated.

What does the anatomy seem to indicate? It shows certain crypts so situated as to afford poor drainage of their contents, even though the superior constrictor, palatoglossus and palatopharyngeus muscles compress the tonsil with each act of deglutition. This is especially true of those crypts discharging into the supratonsillar fossa. Killian has suggested that the supratonsillar crypts be opened with a sharp knife and that the incised surfaces be painted with 5 to 20 per cent trichloracetic acid. By this opening of the crypts their contents are drained. The acid applications excite a violent inflammatory reaction which results in the contraction of the tonsil tissue. The process is often an extremely painful one and may result in cellulitis and scar tissue. Furthermore, it does not always prevent further infection through the tonsil. It is, therefore, often necessary to repeat the incisions and acid applications.

The patient is entitled to immunity from tonsillar infection if it can be established without seriously jeopardizing either his health or life. When the tonsil becomes a well-established atrium of infection the physical economy of the patient is constantly menaced by conditions ranging all the way from a follicular tonsilitis to endocarditis and pulmonary tuberculosis. Measures should, therefore, be adopted which will ensure future freedom from infection through the tonsil.

It has been shown by abundant clinical experience, that cauterization of the lumen of the crypts or obliquely across them into the surrounding follicular tissue, does not adequately meet the indications.

The same is true of "decapitation" or partial removal of the tonsil. Decapitation leaves the deep and more diseased portion of the crypts, and while it may afford some relief of the symptoms, it is often followed by recurrent infections, and by the reformation of the tonsillar tissue.

The complete removal of the tonsil with its capsule intact is, as far as I know, the only mode of surgical procedure that guarantees immunity from infection through the sinus tonsillaris.

The function of the tonsil and the effect of its complete removal upon the general condition of the patient must be considered; so also, must the question of hemorrhage. In reference to the effect of the removal of the tonsil upon the general system it may be said that there is little evidence that it has any deleterious result. Masini, however, believes that the tonsil has an internal secretion comparable with that given off by the suprarenal gland. He arrived at this conclusion after experiments with the aqueous extract of the tonsil, intravenous injections of which gave the same results as obtained from the injection of suprarenal extract.

The last word concerning the treatment of the tonsil can not be spoken until its exact function is established. Clinically, there is little to show evil effects from its removal, whereas there is much evidence to show the good resulting from its removal, especially its complete removal.

I have attempted its complete removal with the capsule intact in about 400 tonsils during the past four years, and, barring one or two instances in which there was a temporary paresis of the palatopharyngeus muscle and a half dozen moderate hemorrhages, I have seen no untoward result. The general health of many was greatly improved and recurrent septic inflammation within the sinus tonsillaris has been eliminated. Recurrence of the tonsillar tissue has not taken place in a single instance. The fact of its regrowth is almost prima facie evidence that the entire tonsil was not removed. I will not attempt to deny that follicular tissue can be removed from the sinus tonsillaris after the complete removal of the tonsil, and that follicular tissue may develop within the sinus tonsillaris. But this should not be mistaken for the recurrence of the tonsil. The tonsil is an encapsulated mass of lymphoid tissue characterized by numerous crypts.

Having removed the entire tonsil with its fibrous envelope and its crypts, the chief source of infection is removed. It is, of course, possible for the follicular tissue which surrounds the tonsil to become diseased, but this should be differentiated from tonsillar disease. When the tonsil is not removed with its capsule intact, it is, of course, impossible to determine whether it has been entirely removed; and if a part of it is left regeneration might well take place. With these facts in mind, it is apparent that the complete removal of the tonsil should show a distinctly defined mass of lymphoid tissue enveloped within a fibrous capsule on its outer, and with mucous membrane on its inner aspect. Lymphoid tissue which is not thus characterized is not tonsil tisue.

Hemorrhage.—The danger from hemorrhage, is, perhaps, the greatest "bugbear" of the operation. Is this a real or an imaginary obstacle? It is both. It is real in so far as severe hemorrhage does occasionally occur in tonsil operations. It is imaginary in so far as the reputed frequency of its occurrence, and the degree of the danger attending it. A clear knowledge of the possible sources of hemorrhage will enable the operator to largely exclude its occurrence. Furthermore, there are certain matters in the technic of local anesthesia, and in the after-treatment, which, if properly applied, will greatly reduce the frequency and amount of hemorrhage. Clinically, I have observed that the most frequent site of arterial hemorrhage is, at about the middle portion of the sinus tonsillaris, where the tonsillar branch of the facial pierces the superior constrictor muscle of the pharynx. Other points of hemorrhage are usually limited to the inferior portion of the sinus tonsillaris where the tonsillar venous plexus is located, and to the anterior and posterior pillars.

In another part of this paper I have referred to the fact that three arteries, the tonsillar, the ascending palatine, and the ascending pharyngeal, pass upward on the outside of the superior constrictor muscle which they pierce as they turn inward to ramify the tonsil and faucial pillars. Just before entering the tonsil they break up into several branches. It is obvious that the smaller the branches cut during an operation, the less serious the hemorrhage. The clinical application of this fact is that if the arterial branches are severed as they enter the capsule of the tonsil the liability to hemorrhage is reduced to

the minimum; whereas, if they are severed on the outer aspect of the superior constrictor muscle before they are broken up into smaller branches, the danger from both primary and secondary hemorrhage is greatly increased. It may be said that the operator should not injure the superior constrictor muscle in this operation, and this is true. Indeed if he thoroughly appreciates the clinical significance of the anatomy of the tonsillar region he probably will not injure it. There's the rub.

As to the anterior pillar, it should be borne in mind that there are arterial twigs coursing upward through it. The main trunks of the arterial branches are external to the palatoglossus muscle. Hence it follows that in order to injure them it is necessary either to pass the instrument behind the muscle and thus injure them, or to include the musculature of the anterior pillar in the grasp of the tonsillitome, knives, blunt dissectors or scissors, etc., and thus sever the muscle and vessels of the anterior pillar. The same statements may be made in reference to the posterior pillar.

The technique should, therefore, be such as to avoid injury of the muscles bounding the sinus tonsillaris, namely, the superior constrictor of the pharynx, the palatoglossus and the palatopharyngeus muscles, as by so doing the larger trunks of the tonsillar arteries are injured.

The technic of the complete enucleation of the tonsil with its capsule intact is shown in the following illustrations:
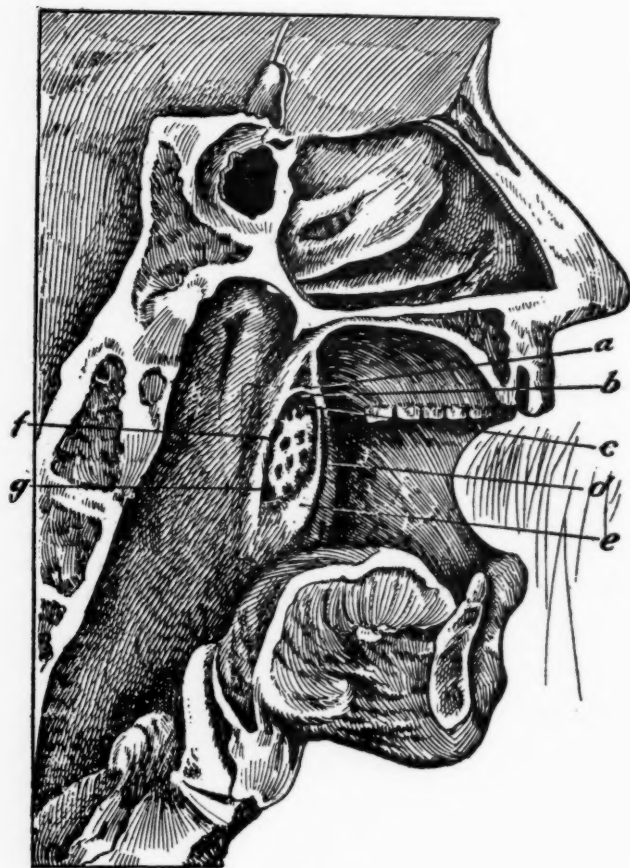
Fig. 1.

Fig. 1.—(a) Supratonsillar border.   The membrane covering
the supratonsillar fossa is known as the supratonsillar fold.   The
supratonsillar margin is the edge of this membrane. (b) Supra-
tonsillar fossa.   (c) Openings of the supratonsillar crypts.
(d) Anterior pillar.   (e) Triangle fold.   (f) Posterior pillar.
(g) A large deep crypt under the inferior portion of the pos-
terior pillar.   This crypt often retains secretions and bacteria
and gives rise to local and general trouble.
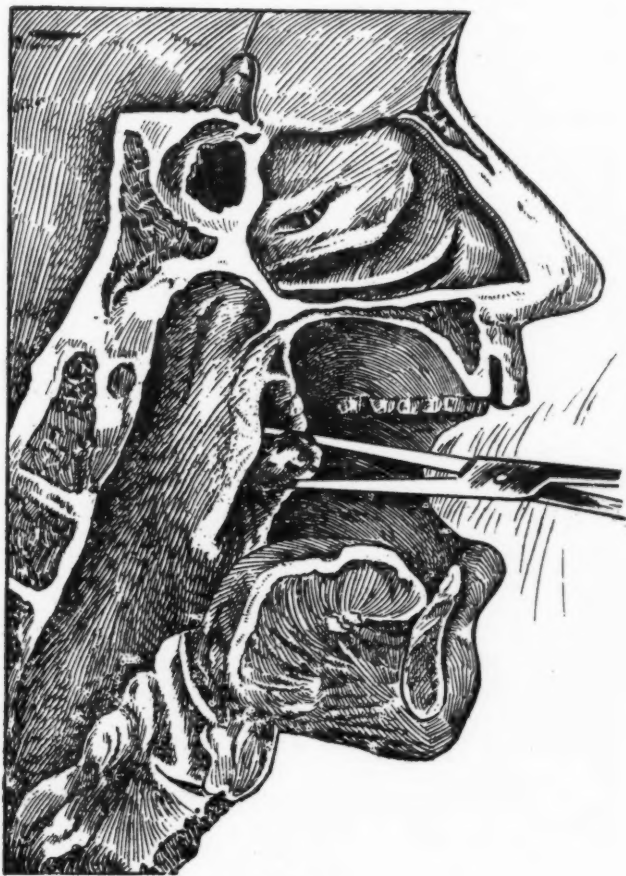
Fig. 2.

Fig. 2.—Showing the tonsil firmly grasped by the tenaculum forceps. The upper point of the forceps is in the supratonsillar fossa, while the lower is in the base of the tonsil. The mass of the latter is thus compressing between the blades of the instrument. Traction within and forward stretches the pillars and triangular fold and permits dissection. It also, as shown by Wilson, draws the tonsil away from the internal carotid.
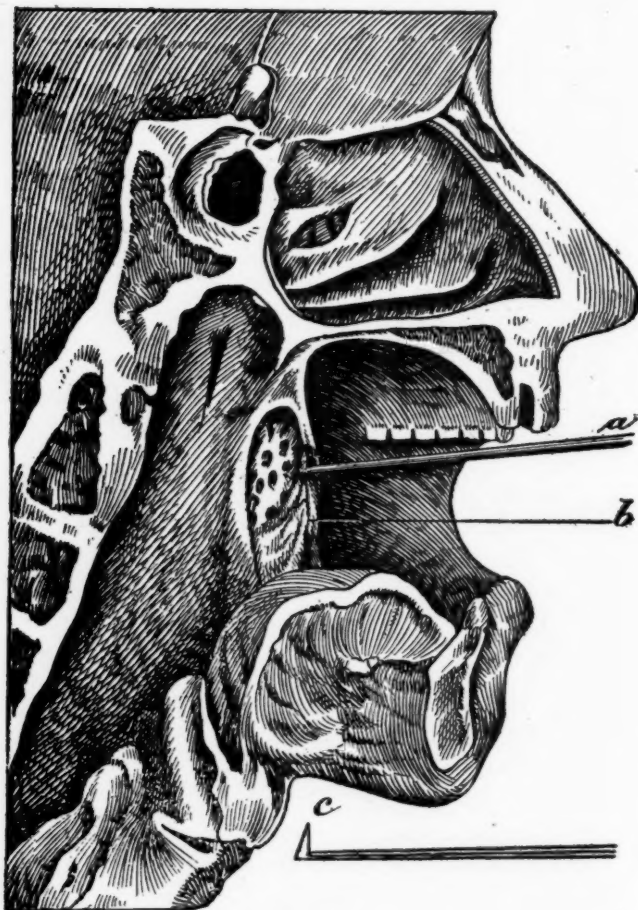
Fig. 3.

Fig. 3.—Showing the anterior pillar in the method of dissection by the Kyle right-angle knife. The bent blade is inserted into the mucosa at b and raised to a without cutting it; it thus includes a larger mucous surface. It should at once be drawn inward and forward, thus making an incision from a to b. The incisions should be prolonged so that the blade passes back to the region of the upper part of the tonsil and midway almost toward the base of the posterior pillar (see Fig. 4). The incision along the anterior pillar should begin at the junction of the pillar and the triangular fold. This will be rendered more easy by seizing the tonsil in the manner shown in Fig. 2 and drawing it inward and forward. Thus seized the tonsil may be turned up, either in its lateral or vertical axis, and thus the posterior pillar is put into a position such that the knife has easy access. (c) Kyle's right-angled bistoury.
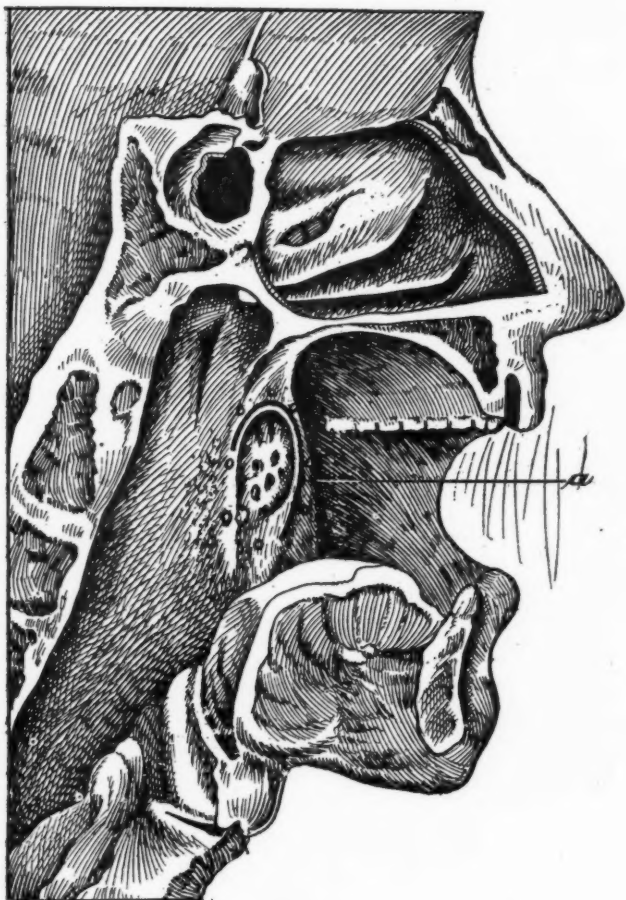
Fig. 4.

Fig. 4.—Showing the extent of the incision. Disengagement of the anterior pillar from the triangular fold—breaking up adhesions—is important. The triangular fold is removed with the tonsil. The seven small circles about the tonsil indicate the points for injecting the cocain-adrenalin mixture.

The formula recommended by Dr. Moss is as follows:

R Adrenalin, 1 to 2000.

Cocain hydrochlorate q. s. to make 2 per cent.

There should be injected at each of the points indicated 2 or 3 divisions of the syringe. The anesthesia is immediate and complete and hemorrhage is almost completely prevented. In a series of 50 cases, there was only a single case of cocain poisoning, and it was not serious.
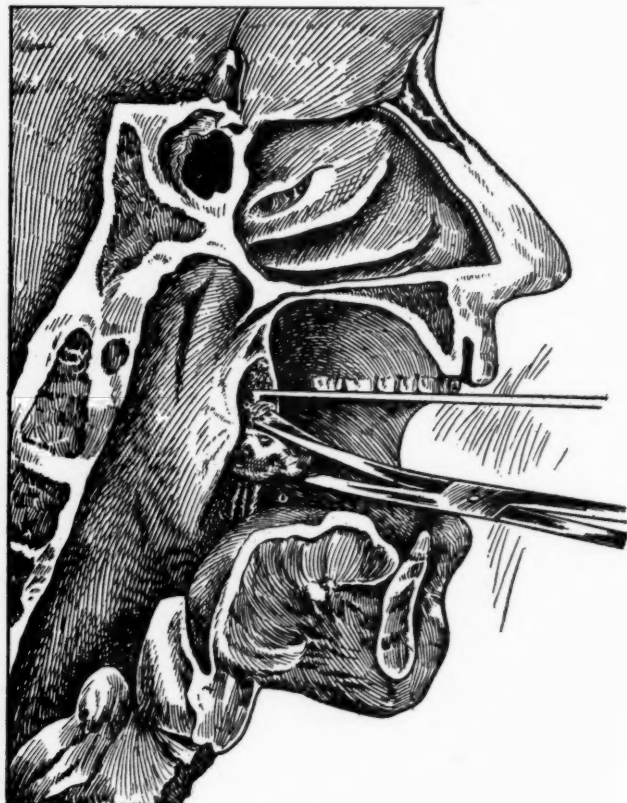
Fig. 5.

Fig. 5.—After having separated the pillars from the tonsil and triangular fold, the dissection is continued with the Kyle bistoury. The tonsil is seized deeply with the tenacular and drawn inward and forward. Thus the fibrous ligaments fixing it to the aponeurosis covering the superior constrictor of the pharynx are disengaged. These ligaments must be cut with the knife close to the fibrous capsule of the tonsil, taking care to avoid wounding the superior constrictor. In dissecting the tonsil capsule only a few small arterioles are cut, while if the muscle is cut, larger arterial branches will be divided and the hemorrhage will be greater.

It is necessary for the bistoury to be sharp. Secondary hemorrhage is often due to septic infection of a clot. Infection takes place more easily in a contused wound than in an incised one, hence the advantage of using a sharp instrument.
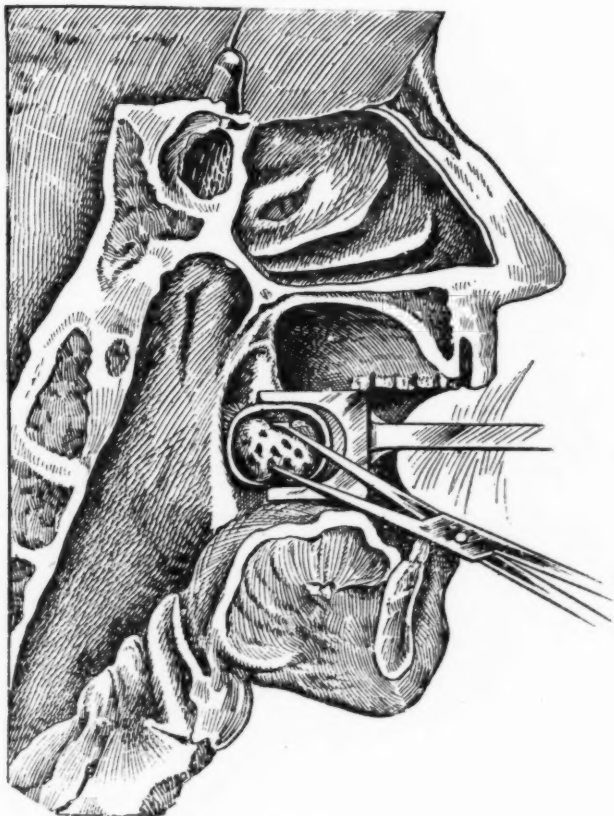
Fig. 6.

Fig. 6.—Showing the writer's ecraseur tonsillotome completing the ablation of the tonsil after its partial enucleation by dissection with the Kyle knife. It is better from a surgical viewpoint to complete the dissection with a sharp bistoury, if possible; secondary hemorrhage is less likely to occur. The chief difficulty is that the tongue often hinders this step. The ecraseur takes the place of the snare and it is always ready for use without introducing a wire or other cutting agent.
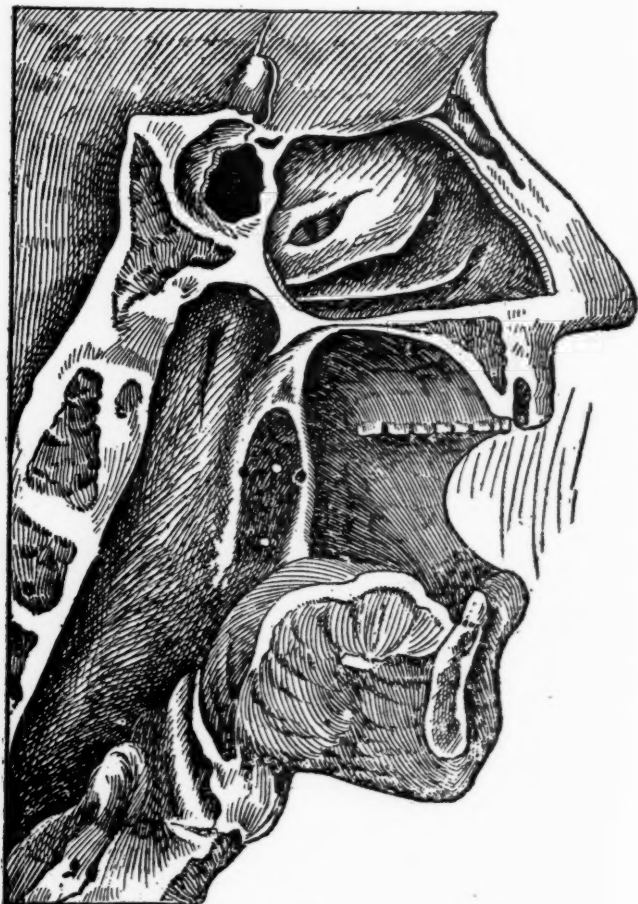
Fig. 7.

Fig. 7.—Showing the site of the tonsil after complete enucleation of the latter with capsule intact. The upper white point has been the region where, in the author's operations, hemorrhage most frequently took place. The lower white point is the seat of the tonsillar venous plexus. The black points upon the pillars are other sites of arterial hemorrhage when the musculature of the pillar is wounded.

LXXXI.

SOME OBSERVATIONS OF SUBMUCOUS RESECTION OF THE NASAL SEPTUM BY THE OPEN METHOD.

BY JOHN EDWIN RHODES, M. D.,

ASSOCIATE PROFESSOR OF DISEASES OF THE CHEST, THROAT AND NOSE, RUSH MEDICAL COLLEGE,

CHICAGO.

No operation in the domain of rhinologic practice has so quickly and justly become popular as that of submucous resection of the septum narium. That it is adapted to the correction of nearly every form of deflections and exostoses, is now generally, conceded. While the literature has become burdensome, and the instrumentarium a constantly increasing factor, the workers in this line have been simplifying methods, perhaps not always to the betterment of the operation, but certainly to its popularization. Simplicity, however, at the sacrifice of thoroughness, has been a tendency that should be criticised, and the aim should be here, as in other surgical procedures, to obtain a result as perfect as possible. Adopting the incision and the instruments as first recommended in this country by Freer, when his early articles were written, an increasing experience has demonstrated to my satisfaction, that for perfection of detail and result, they are all that can be desired in this operation.

There are some things that experience has emphasized, and to a few of them it seems desirable to call attention. In the adoption of the anterior reversed "L" flap, an open method is obtained, the advantages of which do not seem to be appreciated by many operators. The main reason for it is that it undoubtedly furnishes easier access to the operative field than any other, and permits most minute inspection of every part during the progress of the operation, nothing being done in the dark or at haphazard. I deprecate the tendency of many good operators to ignore this, and

cannot but venture the belief that this often leads to a poor
result, in which projecting remnants of the septum are left
above and below the portion of the main deflection which
is easily excised by whatever method used, but the excision
of this portion of the deviation alone often leaves an im-
perfect result. The reversed "L" flap has to be dissected
upward and forward toward the anterior angle of the pa-
tient's nose, and probably the supposed difficulty of accom-
plishing this has deterred many from using it. I have found,
as a matter of fact, that if the incisions outlining the flap
have severed the perichondrium, it is, as a rule, easily re-
flected forward with a dull edged elevator, if the ala of the nose
is well retracted and the head of the patient is held so that
the side of the face is partly toward the operator, as this
position exposes the side of the septum and the site of the
flap perfectly to view. When the flap has been dissected up
it is easily held out of the way in the anterior angle of the
nose, by retractors. One of the main advantages of this
flap, when thus made, is that it affords easy access to the
field of operation. The perpendicular incision having been
made at the summit of the angle of the septum, the denuda-
tion of the crest begins here and it is usually quite easy
to continue it backward from this incision, much more so
than when the cut has been made, after the Killian recom-
mendation, anterior to the crest. Another important merit of
this incision is that it much simplifies the cutting through
the cartilage. When the flap is reflected the operator has
before him a snow-white bared surface of semi-transpar-
ent cartilage, in which the movement of the edge of the
knife is distinctly visible. This view, and the tactile sense,
show perfectly when the edge of the knife has cut entirely
through the cartilage, and there is little danger of cutting
through the mucous membrane of the opposite side. He
soon finds that he has little fear of this accident to the mem-
brane of the opposite side, for he can watch his blade in
the cartilage, and by turning it slightly on the flat, uplift
the severed edge of the cartilage as soon as he has pene-
trated it, and immediately begin dissection of the membrane
on the concave side. Where the Killian incision and its
modifications are used, the incision through the mucous mem-
brane and the cartilage coincide, the cartilage lying buried
beneath a varying thickness of membrane. It is, therefore,

difficult for the operator to tell when he has fully severed both. Without doubt this has been the reason for the suggestions that have been made of the tedious process of curetting through the cartilage with a sharp spoon or other scraping instrument, the operator feeling in the other nostril for the evidence of penetration and being relieved if a hole has not been punched in the mucous membrane of the other side. Another thing is to be considered, namely, that this method of scratching through gives a small hole only through the cartilage furnishing an inadequate field for the rapid denudation of the concave side of the deviation. The flap method, on the other hand, permits the exact division of the cartilage in front, with a keen blade, and a large cartilaginous flap may at once be outlined, which gives the widest approach to the concavity of the septum, all of which can then be dissected under the eye of the operator.

The button-hole incision, and the removal of a large cartilaginous and bony deflection of the septum through a small opening, is alluring, and the boasted ease with which some operators have declared the operation can be done has led many to adopt a method that has resulted in half success, with a subsequent dissatisfaction with the results of the operation. With the open method, I am satisfied this defeat of its purpose would be scarcely possible. The protection of the incision, through the cartilage, by the flap which should cover it perfectly, would prevent perforations of the septum far in front, a most undesirable and annoying complication.

When the dissection of the mucous membrane on both sides of the septum has been completed, the removal of the cartilage is the easiest part of the operation, by whatever method it may be done. The rapidity with which this is accomplished is not important. The all-important thing is the complete removal of the obstruction, and the subsequent relief of the patient. This involves the operation upon both bone and cartilage in nearly all cases.

The theoretical objection that the flap method leaves a raw surface to granulate after the operation, is not tenable, for, when the opposing surfaces are brought into close contact by the tight packing with narrow strips of surgeon's lint impregnated with bismuth subnitrate, built up in layers from the bottom of the cavity like a wall and which remain for four or five days, it will be found that the parts have healed

by first intention. This method of packing, and the free drainage furnished by the incisions, make impossible any collection of blood or fluids between the opposing layers of mucosa perichondrium or mucosa periosteum, a complication that has been noted sometimes in the single line incision.

The superior maxillary crest is so commonly an important part of the obstruction in deflections that its removal should be accomplished, in part at least, in nearly every case. This is often the most difficult feature of the whole operation, but the success with which this is done will determine whether it has been entirely satisfactory or not. The denudation of the crista of its overlying mucosa, because of its tenacious adhesion to the bone, makes the use of a sharp elevator absolutely necessary. The most suitable instrument for this purpose is the "A" knife of the set. There is great danger of perforation if the dull elevator is employed, and much force used. The crista is often so buried in its coverings that it is invisible and must be felt for carefully. It can always be exposed from above, and the "A" knife can be carefully passed down close to the bone beneath the mucous membrane on both sides, finally exposing it to the floor of the nares. It would hardly seem necessary to complicate the operation by making an incision across the nasal floor, and dissecting upward, as suggested by Yankauer. For cutting away the bared bone, the strong and larger forceps are often necessary on account of its exceeding density. With the patient sitting upright in the chair, the position assumed by the operator is a half crouch, with the kness bent, bearing down toward the floor of the nares with the jaws of the forceps, slipped over a portion of the crista. It can easily be removed with successive bites of the instrument. The smaller forceps are often required for removing remaining portions of the cartilaginous deflection above or of the vomer behind.

There is no doubt that the preservation of the perichondrium and periosteum is essential to the restoration of rigidity of the septum. When we remember that the mucosa is quite freely movable upon these and that they lie in distinct layers, it will be seen that it is the mucous membrane alone that would probably be lifted in many cases, if the parts cannot be under direct inspection. The result would be a flaccid and baggy condition of the septum, which would

make respiration little less difficult, in some cases, than it was before the deflection had been removed.   Heavy instruments and blind force used in elevating the mucosa, inevitably result in violence to the soft parts, inflaming them and lessening their vitality, or making perforations.   With keen dissection and gentle elevation, such complications are rare, even the site of close adhesions that follow previous sawing or cutting operations yielding to this delicate and careful surgery.   I have demonstrated its efficacy in children, and it is largely due to the minimum of mechanical injury as well as the painlessness of the operation.

The painlessness of the operation on the septum has been demonstrated many times when the anesthesia has been induced by the application of cocain crystals to the mucous membrane.   I am convinced that its use in the way here recommended is no more dangerous than by the usual method with watery solutions of varying strengths.   Indeed, I have yet to see any toxic effect to any marked degree in my own operations, and Freer's record of nearly two hundred cases in which he has applied it in this way, would tend to prove that it has not the elements of danger that have been claimed in some discussions.   There are undoubtedly individuals who are extremely and dangerously susceptible to the toxic effects of cocain in any strength of solution.   I believe the applications of cocain, as recommended by others, to induce local anesthesia, are as dangerous as when used in the concentrated form, if applied as here suggested.   The anesthetic is brought into contact with the highly vascular turbinated bodies as little as possible, as it seems to pass rapidly into the circulation from them.   I have seen more toxic effects, and in a larger proportion of cases, from the application of a four per cent solution of cocain to the turbinated bodies, than from the application of the crystals of the same drug to the septum alone.   Only small quantities are used, and they are applied to the site of operation   Immediately preceding the cocain, a fresh 1-1000 solution of adrenalin chloride is used and the membrane of the septum is thoroughly decongested.   By limiting absorption this probably lessens the danger of toxicity.

The method employed is to first swab the entire nasal mucous membrane with a 1-1000   solution   of   fresh   adrenalin chloride.   In five minutes the cocain crystals are carefully

applied to both sides of the septum, being entangled in a small pledget of moistened cotton which has been wound tightly on the end of a slender probe. The cocain is rather freely used, but care is taken to rub it only over the site of the operation, which usually includes the cartilaginous septum and the anterior portion of the vomer. In five minutes the anesthesia will be found complete. During the progress of the operation it may be used both as an anesthetic and as a hemostatic. For the latter it often does better than the adrenalin, which acts promptly and efficiently in most cases.

LXXXII.

THE CATHETERIZATION TREATMENT OF ACUTE FRONTAL SINUS INFLAMMATIONS BY THE INTERNAL METHOD.

By Holbrook Curtis, M. D.,

NEW YORK.

The external methods employed in the operative treatment of frontal sinus empyemata have occupied so much space in rhinologic literature of late, that a word as to a more conservative method of dealing with this interesting condition may not be amiss. In 1902 a paper was read by the writer before the American Laryngological, Rhinological and Otological Society, in Washington, entitled "The Technic of Frontal Sinus Operations with Reports of Three Cases Treated- Without Nasal Drainage."*

These cases which were exhibted at the New York Academy of Medicine in the May meeting of that year, were the first cases in which the method of open wound dressing, similar in every particular to the dressing employed in the after-treatment of a mastoid abscess was advocated. Since that time some surgeons have gone to such extremes in their desire to operate externally that more conservative methods have been disregarded. A reason which has led to the popularity of the external methods of operating in almost every case is undoubtedly because of the erroneous opinion which prevails that the internal method of entering the frontal sinus is fraught with great danger to life. Unhappily, this belief has caused an unsightly scar upon the brow of many victims of the surgeon's prejudice.

From the opposite point of view, the operator may point to the sinus lined with polypoid tissue and ask, could that ever have been cured without a curettage of the cavity? My answer to this question would be to point to many cases upon which an operation has been advised by the surgeon and re-

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*Laryngoscope, July, 1902.

fused by the patient, in which careful treatment, as indicated below, if it has not been curative in a physiologic sense, has relieved the patient of all his pain and discomfort.

Far be it for me to decry the external operation, for in the

hands of the skillful operator the most brilliant results are attained. The method advocated in this sketch is one which in the writer's opinion should precede the radical external operation in almost every instance, both on account of its simplicity and utility. It is surprising how many apparently chronic cases will cease discharging pus after two weeks' treat-

ment. The patient is taught to introduce the catheter himself and to douche as frequently as the condition warrants.

The illustration shows the catheter employed for douching, which is made of silver by Tieman.

The method of entering the frontonasal duct is as follows:

Cocain hydrochlorate, 10 per cent solution, one part, and adrenalin chlorid 1-1000 solution, one part, are mixed and applied on a cotton pledget for twelve minutes to the anterior tip of the middle turbinate body and roof of the middle meatus.

The tip is next removed by Grünwald forceps and the snare, exposing the ethmoid cells between the internal lamella of the ethmoid and the orbital plate. A small cutting forceps is then employed, in the direction from the middle of the vestibule toward an imaginary line a centimeter below a line which would pass through the inner canthus of both eyes, and the cells are broken down. A blunt barrel drill run by an electric motor completes the removal of these cells.

It is easy to feel the greater resistance of the internal lamella and orbital plate while operating. After the turbinate is removed, we frequently find that the cell structures are so delicate that any blunt instrument like an Eustachian catheter is sufficient to break them down. If we are careful to keep outside the lamella and hug the orbital wall, we need not fear penetrating the cribriform plate.

In using the probe end barrel drill on older persons with hard cell walls, care should be taken to cut in a forward direction, using the forefinger on the upper lip as a fulcrum and inclining the drill at a radius more toward the perpendicular as we break down the cells from behind forwards. One feels at once when the frontonasal duct is encountered, a fact which we verify by catheterizing and syringing. The patient is always able to tell when the warm antiseptic solution enters the sinus. He generally feels it "back of his eye and in his forehead." This operation upon the living subject is a very simple procedure, however complex it may appear upon the skull.

The sinus catheter is made with a bulb to slip into the tube of an Amberg ear syringe, and has a plate to indicate the direction of the beak, as well as for the purpose of hold-

ing the instrument firm;y. I do this operation so frequently in my office as a routine procedure that I regret I have not tabulated my cases carefully, but in considerably over one hundred and fifty cases operated upon, I have never had any untoward accident whatsoever.

So much for the danger of procedure.

As regards the results obtained, it may be said that they are curative in acute cases and in chronic conditions afford so much relief that many patients who have been advised that an external operation is imperative, are content to treat themselves by douching their sinuses as necessity demands. The number of cases that are free from pus after a year of douching, is remarkable—and not in accordance with theoretical presumption. Later, it is the intention of the writer to collect statistics from cases, many of which have escaped observation, and elaborate a more extensive article on the subject of frontal sinus treatment.

In illustration I cite a few cases in which douching the sinus has been employed.

Case I.—Miss B., saleswoman, age 35. Has had excruciating pain over left eye, accompanied with profuse discharge from left nostril for a period of over ten years. Inferior plate of sinus very sensitive, eyelid frequently swollen. Would not submit to external operation. Operated internally in March last and douched. Patient has continued douching only when she takes cold, as at other times the discharge is insignificant and pain has entirely ceased. Sometimes there is no discharge for two weeks.

Case II.—Mr. J., age 55. For twenty years has suffered from "facial neuralgia, followed within a few days by a violent catarrh after every attack." Pain has been so severe that morphin hypodermically became a routine treatment. Attacks occurred about four times a year. More or less persistent discharge from right nostril. Patient was operated upon in April, 1903, and the right sinus douched daily for two weeks, since which time the pain and discharge only occur upon taking cold and are readily overcome by two or three hot boric douches through the catheter. In this case an external operation was apparently justified.

Case III.—Mr. B., age 35. Has had a double frontal sinusitis and both antra affected. Most violent pain a symptom. Returned from hunting trip in agony after a two weeks' awful

experience. Operation in February last, consisted in entering both frontal sinuses and douching. Two days afterward operated on the antra by perforating the inferior meatus walls. All four sinuses were syringed every few hours with hot antiseptic solution, which stopped the pain almost immediately. All discharge stopped only after four weeks' continued irrigation.

Case IV.—Mrs. D., age 37. Presented herself in September, 1903, in great pain over the left eye, with profuse discharge from left nostril. I had done a radical antrum operation through the canine fossa the year previously. Pain was so intense that she begged me to perform the external operation upon her sinus. I persuaded the patient to allow me to operate within and catheterize the cavity, which proceeding stopped the pain and the discharge disappeared within two weeks. There has been no recurrence.

I might append scores of similar cases, but it seems unnecessary in a brief sketch of this interesting subject.

LXXXIII.

ON THE PERMANENCE OF THE IMPROVEMENT IN THE SHAPE OF THE NOSE OBTAINED BY THE SUBCUTANEOUS INJECTION OF HARD PARAFFIN.

By WALKER DOWNIE, M. B.,

LECTURER ON DISEASES OF THE NOSE AND THROAT, GLASGOW
UNIVERSITY AND WESTERN INFIRMARY.

It is now close on five years since I first made use of a preparation of hard paraffin, injected subcutaneously, for the removal of deformities of the nose.

In the interval I have, on more than one occasion, demonstrated the good results obtained. The improvement which follows the operation is evident to any unprejudiced observer, and in almost every case is the patient well pleased with the result.

Of the many questions which have from time to time been asked of me regarding the behavior of the injected paraffin, two stand out prominently, namely: (a) Is the paraffin after injection affected by heat? and (b) Is the improvement, obtained from its use permanent?

As these are questions of the first importance, and points on which the patient should be fully satisfied prior to the performance of the operation, I will, by way of answer, refer to my own experience.

1. What is the effect of exposure to heat? Is the paraffin in any way affected or altered when the patient is exposed to a high temperature subsequent to the operation, either from residence in a tropical climate or from the exposure of the face to great heat, such as is necessary in the pursuit of certain occupations?

So far as my experience goes, climate exercises no effect whatever on the paraffin lying in the subcutaneous tissues.

Amongst the many patients on whom I have operated, are men resident in various countries where the temperature is that of the tropics, in India—Burma, Bengal and Bombay—

in South America and South Africa. In none of those cases, so far as I am aware, does the paraffin appear to have been altered or affected in any way by the hot climate, nor has the deformity recurred.

Again, several of the men on whom I have operated in hospital are employed in some of the large iron and steel works for which the upper ward of Lanarkshire is famous, and in none of them has the injected paraffin been apparently affected by exposure to the heat radiating from the molten metal or from the boiler furnace.

The first case in which I employed hard paraffin for the removal of a deformity of the nose was that of a woman, and who, for purposes of observation, was detained as an in-patient for some weeks, during which time she willingly assisted the nurses in the work of the ward. On one occasion she was set to smooth some cloth with a hot iron. She went to the ward kitchen to do it, but returned shortly, saying she was tired, and went to bed. Next day she confided in the ward sister and told her that she had not really been tired but she feared that the heat from the iron would melt her nose. She has now, for five years, been doing all kinds of household work—cooking, ironing, etc.—and the shape of her nose to-day is practically identical with the form shown in the photograph taken two weeks after the injection had been made.

2. Is the improvement brought about by the introduction of the paraffin permanent? Does the injected paraffin remain *in situ* as time goes on, does it migrate, or does it become absorbed?

Some observers contend that the injected paraffin is slowly resorbed or "swallowed up" by the tissues, a process similar to the resorption or "healing in" of a properly prepared cat-gut ligature. When this process is complete, they say, the parts return to the condition they were in prior to the injection, i. e., the deformity reappears. Others think that by some unexplained process, the paraffin, while not becoming absorbed, disappears or is dispersed, so that the deformity recurs in time; while others again have said that the injected paraffin becomes in time replaced by fibrous tissue, the presence of which prevents the reappearance of the deformity, or the deformity, at least, is less evident than prior to the injection.

On the 2nd of March, 1906, I made some remarks on this subject at a meeting of the Laryngological Society of London, and I illustrated my remarks by the exhibition of photographs of patients who had been operated upon.

These photographs showed (1) the kind and degree of deformity of the nose before operation, (2) the improvement which immediately followed the introduction of the paraffin into the subcutaneous cellular tissue and (3) the shape of the nose in each of those same patients, four years after the operation.

All who saw the photographs were convinced that the shape of the nose as shown (a) in the photographs taken about two weeks after the operation and (b) those taken four years later was practically identical, and that there was no evidence of the reappearance of the deformity which was shown to have existed, by the photographs taken prior to the operation.

But further than this. When those cases were examined four, and in several instances considerably over four, years after operation, the injected paraffin could be felt as a well-defined mass, readily caught up between the finger and thumb, occupying the same site as it did immediately after the injection had been given.

In each case a hard mass could be felt at the site of injection, and in none of the cases had the deformity recurred.

I, therefore, hold that the improvement which follows the careful subcutaneous injection of hard paraffin is, for all intents and purposes, permanent in the majority of instances, and probably it is so in every case where the paraffin has been properly introduced.

I also hold that the paraffin remains *in situ* indefinitely. This latter opinion is based on two grounds:

1. The character and shape of the mass felt beneath the skin when examined externally with fingers.

When the body is grasped between the finger and thumb it is hard and somewhat rounded, quite unlike bands of fibrous tissue, and its size and position are similar to those of the paraffin tumor as felt on examination immediately after its introduction.

2. The nature and appearance of the paraffin when removed from the tissues months and years after its introduction.

I have on three occasions been called upon to remove paraffin from the tissues, twice from the nose and once from the supraorbital region.

In one case the paraffin had been injected by a surgeon in Manchester with the object of raising the bridge of a sunken nose, and a quantity far in excess of the requirements had been introduced. The result was a nose enormously swollen externally and livid in color, with considerable nasal obstruction. The latter was caused by the presence of a series of hard tumor-like swellings within the nose, consisting of hard paraffin beneath the mucosa. I removed the paraffin which formed the tumor-like swellings, together with much of that which caused the abnormal tension of the skin.

Another case was a girl operated upon in a London hospital for the removal of a similar deformity of the nose, but where a quantity of paraffin had spread to the supraorbital region from which I dissected it out.

A third case had been operated on near Glasgow, where again the injected paraffin had spread beyond the confines of the nose, resulting in a disfiguring swelling over one eye, and which was also removed by the careful removal of the paraffin.

In each case the paraffin was found to be present, and to be in a state of fine division, in small rounded particles, separated by bands of tissue.

The finding of the paraffin in small particles is not to my mind the evidence of the early stage of absorption, for this division takes place at the time of injection. This I showed by the experimental injection of paraffin into a mamma one week before its removal. The conditions found on examination afterwards were reported by me at a meeting of the British Medical Association in 1902. In that communication I reported:

"In section the paraffin appears almost entirely in the deeper parts of the subcutaneous fat. It is distributed throughout this layer in blocks of varying size, the largest being perhaps about the size of a pea. These masses, which are either distinctly lobulated, or more irregular, with rounded processes, occupy in every case a position between collections of adipose vesicles which are displaced by them. It is inferred that the paraffin has made its way along the lines of connective tissue trabeculae between fat containing cells."

And I further expressed this opinion: "From the fact that the infiltration of the paraffin is definite and tolerably intimate, it is difficult to believe that its position would subsequently alter to any extent, although its absorption is possible."

The paraffin breaks up on its introduction into the subcutaneous tissues: it runs along the cellular planes, and it is not eaten into later by the living tissues. The paraffin after injection is held in position by the trabeculae of the minute planes of cellular tissue in the same way as the fat of adipose tissue is kept in place.

Much has been spoken of the migration or wandering of paraffin after it has been injected. While the paraffin in the fluid state is being injected it, of course, follows the line of least resistance, and if permitted it may spread in various directions; but after it has once set, I have never seen it wander beyond the confines of the nose.

In those cases where the paraffin has been found in other parts of the face, such as the infraorbital region over the forehead or over the cheek, I fear it has reached those regions while the injection was being given and while the paraffin was still in a fluid state.

On the other hand, I can understand the wanderings of paraffin which has been introduced in the solid form, as this can never become so intimately incorporated with the tissues as when molten paraffin has been introduced.

The accompanying photographs, which are patients healed by paraffin injection, show the shape of the nose shortly before operation, and again at an interval, varying in the different cases, of from three to five years after operation.
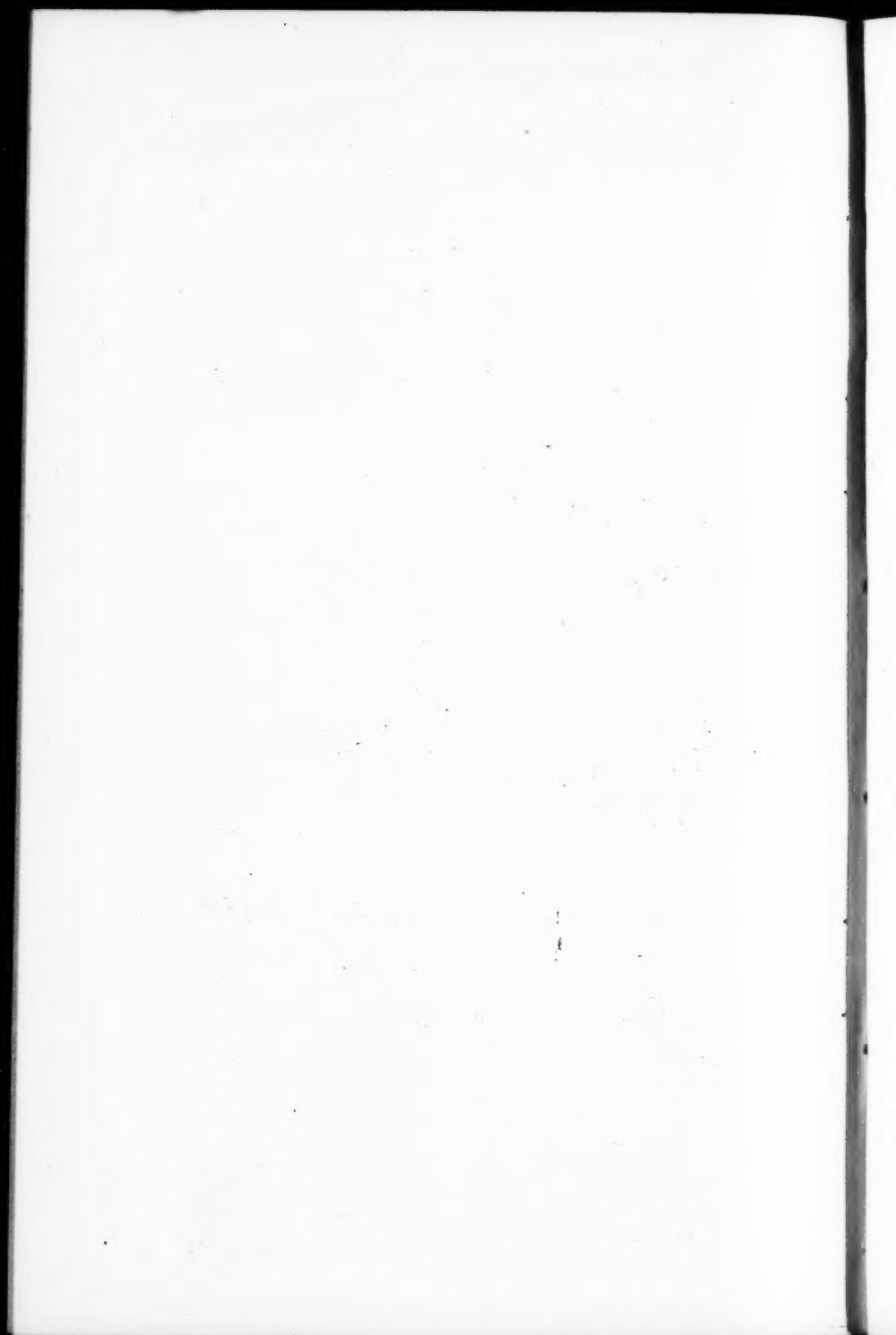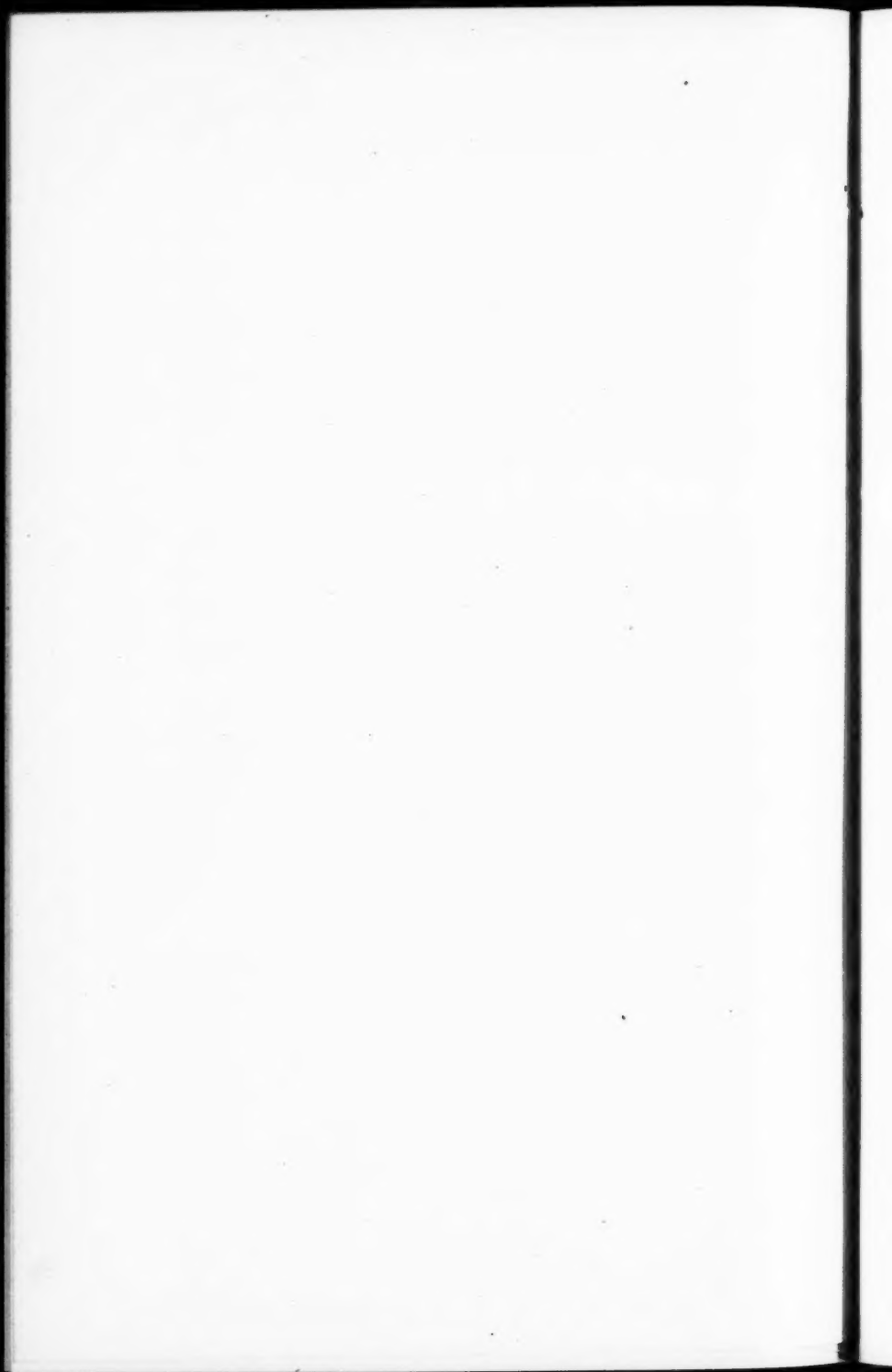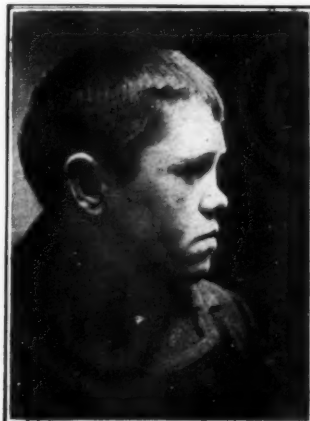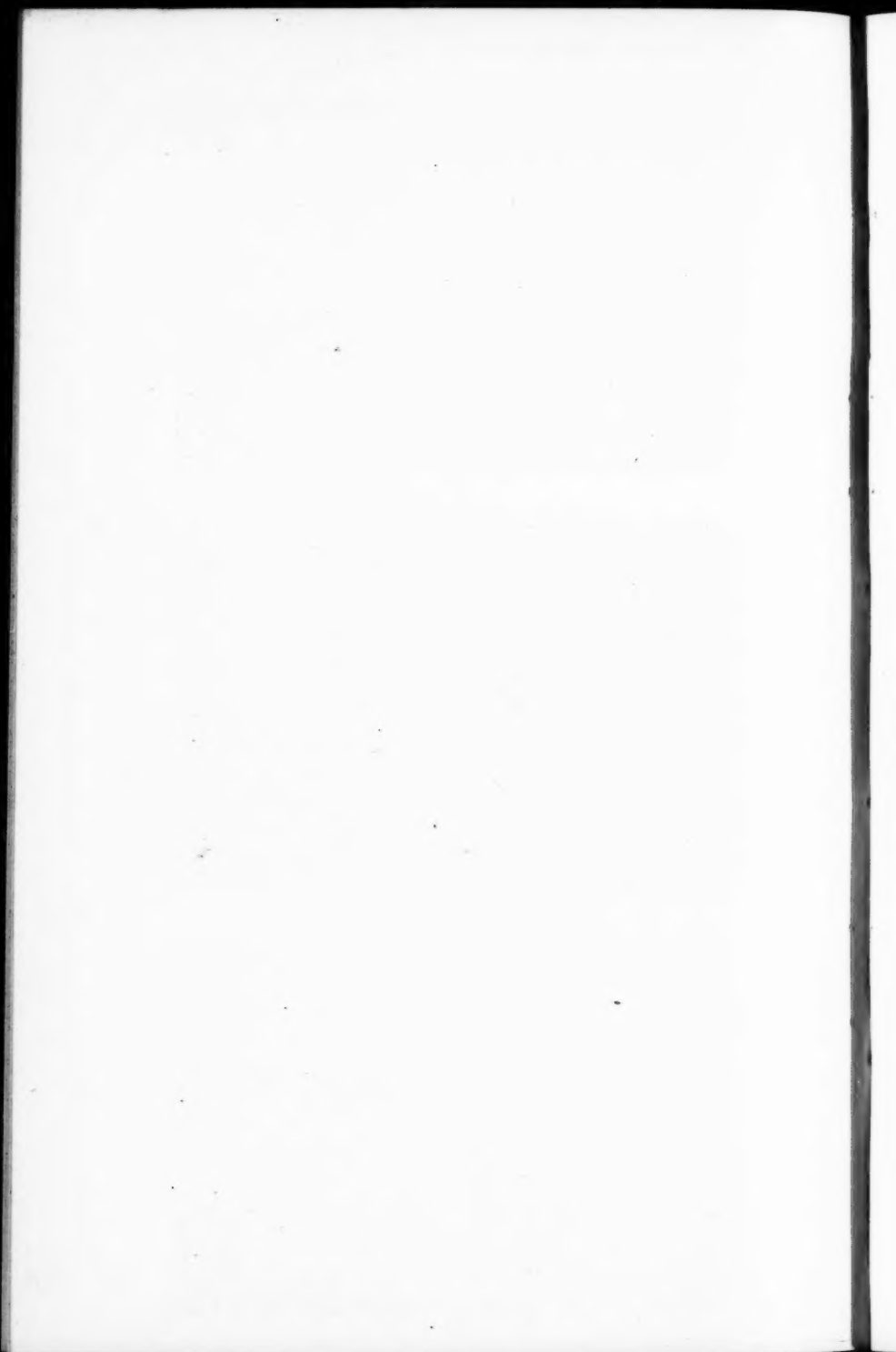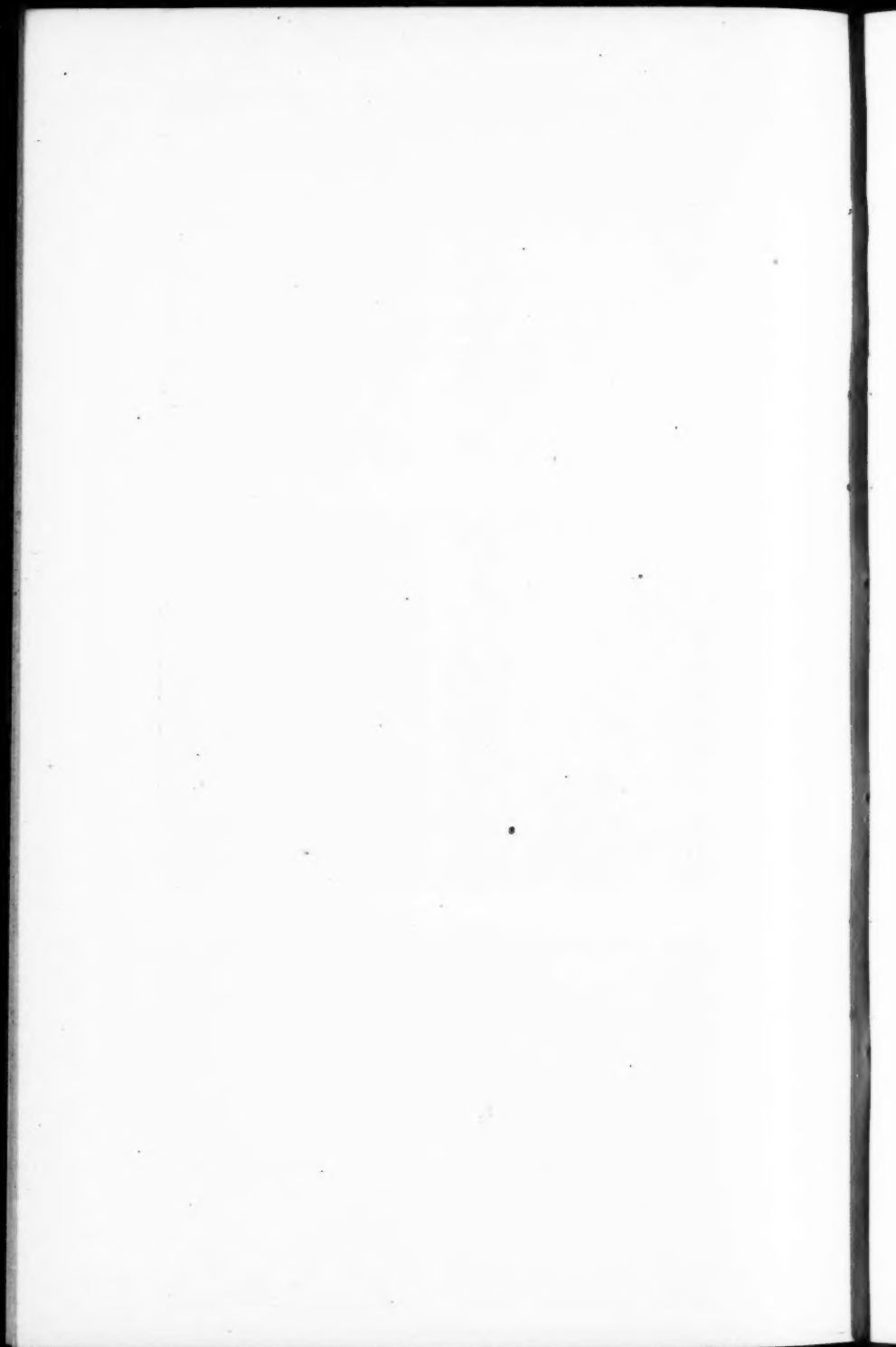
A SHORT NOTE ON SUBMUCOUS RESECTION OF TRIANGULAR CARTILAGE.

By Richard Lake, F. R. C. S.,

LONDON.

Much interest has of late centered round the operation of submucous resection of the triangular cartilage, one of the chief points being the employment of an incision through the mucoperichondrium over the triangular cartilage parallel to, or slanting obliquely up from the floor of the nasal cavity. A second incision is usually recommended at an angle to this one, proceeding upwards.

The former incision possesses two bad points. The first is, that the chief nutrient artery of the anterior septal region is severed with the nasal nerve on the incised side; the second, that the cartilage is not attacked at its free edge. Severing of the nutrient artery appears to me to be a serious consideration quite apart from the temporary though annoying hemorrhage that may be set up; first, because deficient nutrition must act deleteriously in the formation and growth of the new cartilage, which would be thin and very non-resilient; and secondly, that especially if attended with any weakening or injury of the mucosa on the concave side, it is apt to be followed by the appearance of a septal perforation.

This is a condition following the method of Asch with painful frequency and one which also quite commonly put in an appearance after the true "window" operation, which for that reason I ceased to employ in 1891 and which, subsequently, I believe became known as Gleason's, as the first to communicate it to the medical world. Not that a septal perforation is often even known of by the patients, but it seems foolish before the millennium to risk having skillful innuendoes let loose at one's expense by "brother" craftsmen, should such a patient stray into the hands of one not imbued with the ancient if antique spirit of etiquette. But although septal perforations are not always or often annoying, they are very often so, especially to patients who are more or less neurasthenic.

Therefore for two reasons, one for the patient and one for the surgeon, perforations if possible are to be shunned. As a further argument in favor of the advisability, if not absolute necessity, of avoiding the septal artery, I will refer my readers especially to Gerber's atlas and to his views on perforating ulcer of the septum. Also one must remember that the destruction of the sensory nerves leaves the areas they had supplied in a condition which renders them more easily affected by slight trauma, decreasing the resistance of the tissues.

How perforation is always to be avoided when an extensive opening is needed, I do not see, but of late I have been in the habit of making only one incision, as nearly as possible corresponding to the free edge of the triangular cartilage. This incision is almost bloodless, the free edge of the cartilage is found and freed from all soft tissues for a slight distance backwards, the mucoperichondrium is then held by an assistant with clutch forceps, also the columella which are retracted as far as possible. The operator proceeds to remove all of the cartilage he considers necessary, through his opening.

There is always the case in which a much lateralized spur affecting the nasal crest of the superior maxilla requires removal, and then this incision is not alone sufficient and should not be attempted, as it is scarcely possible to exert the necessary force on the sharp edge of bone and not tear through the mucosa.

Another point of especial importance, is that in a large proportion of our cases which require the correction of septal deformities, we find in addition irregularities of the turbinates which require careful and skillful correction in order to enable the new septum to be formed upright and straight, for the air channels should be as far as possible equal in size in order to obtain the best results, and personally the writer invariably uses thin and not too resilient splints.

Asepsis should be obtained and maintained by the use of a nasal wash or spray every two to four hours with a mild antiseptic; for choice 10 per cent of listerine, 5 per cent of acid boric or 5 per cent sanitas. And if any blood has been swallowed an aperient is advisable. Antipyrin, or its equivalent, will relieve the pain and any swelling may be combatted by the employment of an evaporating lotion applied constantly on lint to the nose.

LXXXV.

A CASE OF MULTIPLE RECURRING PAPILLO-
MATA OF THE LARYNX.

By Charles W. Richardson, M. D.,

PROFESSOR OF LARYNGOLOGY AND OTOLOGY, GEORGE WASHING-
TON UNIVERSITY,

WASHINGTON.

During the month of January, 1905, there was brought
under my care, in consultation, a young man, 32 years of age,
who gave the following interesting history:

He stated that, since early childhood, he had more or less
difficulty in breathing, and always a hoarse voice. During
the last four or five years the voice has been continuously
hoarse and rough, and the breathing more or less difficult.
During the last two years, he had not spoken above a whisper-
ed voice, and the breathing during this period had been
so difficult that it had been almost impossible for the patient to
make any active physical efforts. He has had to be very cau-
tious in going about. Several times during the month previ-
ous to his coming under my observation, he stated he had very
violent attacks of difficult breathing, in which it was thought
that the patient would suffocate—twice during the week pre-
vious and the night before he came to me he had attacks
of intense dyspnea—which was the immediate cause of his
seeking my aid. His general history was excellent, and there
was no occasion to suspect anything of a tubercular charac-
ter. There was no chest symptoms of any kind. He was
tall — 6 feet 2 inches — rawboned and weighed 148 pounds.
An examination of his upper air tract showed nothing other
than normal. Inspection of the larynx revealed a condition
which was rather astonishing. Over the whole left side of the
rim of the epiglottis and extending down along its whole
lateral border, there was one continuous mass of papillomatous
tissue. The whole supracordal portion of the larynx seemed
to be filled in with a mass of papillomatous tissue. No space

could be seen which would indicate the interval between the vocal cords. These growths seemed to grow from the aryepiglotidean folds, from the false cords, from the anterior commissure and the whole of the surface of the true cords. The patient's embarrassed respiration and his general appearance excited my greatest sympathy. Recognizing the fact that I had to do with an extreme case of papillomatous degeneration of the whole mucous membrane of the larynx and the probability of eradicating the condition as thoroughly through the intralaryngeal method as through external methods, I decided to send the patient to the hospital where all arrangements were made to do a tracheotomy, in case that the intralaryngeal method should excite any violent paroxysms of dyspnea. The operation was attended with great good fortune and the growth was rapidly and successfully removed from the body of the larynx, from the epiglottis, from the aryepiglotidean folds and from the false and true cords. I then found that there was considerable growth in the subglottic portion of the larynx, especially on the right side. This was all thoroughly and carefully excised. In the summer the patient was practically free from all growth and was allowed to go abroad. Recurrence had been more or less frequent. During the operative stages, growths removed from one point would remain absent and then show up again after a period of two or three weeks or a month. Growth removed from the aryepiglottidean folds, and false cords showed less inclination to recur than those in the subglottic portion of the larynx. When the patient left me his weight had increased to 179 pounds, general health good, and appearance that of perfect physical well-being. In December he wrote me that he was getting more hoarse and that there had been a recurrence of difficult breathing. I advised him to consult Dr. Edward Law, in London, who, after examination, referred him to Sir Felix Semon. I append herewith a letter from Dr. Law, giving a critical extract from Sir Felix Semon's letter to him in reference to the patient's condition:

"On examination I found almost complete apparently papillomatous (I will at once say what I mean by apparently) degeneration of the larynx, involving both vocal cords, both ventricular bands (badly), the lower surfaces of the epiglottis, particularly on the left side, the mucous membrane over the arytenoid (partly) and a considerable part of the

subglottic cavity, particularly on the left side. The movements of the vocal cords were impeded, but not abolished. On the left side, in the middle of the laryngeal degeneration, there appeared to be two cysts filled with grayish fluid. On the right side of the neck there was a big, moderately hard gland not fixed to the larynx. There were no chest symptoms of any kind.

At first sight I should quite agree with the diagnosis of papillomata, but the presence of the large gland drew my attention to the possibility of the whole affection being of lupoid character, and, the patient being 32 years of age, the remote possibility of malignancy must also not be lost sight of, although the extremely long duration of the symptoms (twenty-nine years) would, of course, militate against this hypothesis, unless one were to think of a transition of benign into malignant growths, which, although extremely rare, yet has, as you know, been a few times actually observed. A certainty on these mooted points will, of course, only be got by intralaryngeal removal of a good-sized fragment and careful examination on the part of an expert.

Needless to say, the question of treatment will have to depend to a great extent upon the results of the microscopic and bacteriological examination. If the disease were purely papillomatous, I should be more in favor of a repeated intralaryngeal removal than of an external operation, seeing that the degeneration is unfortunately so universal that even if the larynx were opened and everything thoroughly scraped, no binding promise could be given with regard to non-recurrence.

Should the disease be malignant, nothing short of total extirpation of the larynx and of the affected gland would give any chance of lasting cure.

Finally, should the disease be lupoid, extensive scraping, applications of the galvano-cautery, tuberculin injections under opsonic control would be the best method. I confess that the lupoid possibility only occurred to me after the patient had left me, and I did not discuss this possibility with him or his mother.

Should the intralaryngeal method be adopted, I would insist on the patient's going to a Home until the epiglottis was sufficiently cleared not to fear any sudden obstruction after the operation. Altogether, the case is anything but nice."

My patient, for various reasons, became dissatisfied with the condition of things in London and took the steamer and came immediately to Washington, where he placed himself again under my observation. I found the conditions about the same as described by Sir Felix Semon, except that there was no cyst. What Sir Felix thought was a cyst must have either ruptured or evacuated its contents before he came under my observation the second time. The large gland on the right side of the neck below the angle of the jaw was a broken down, cheesy gland, which I have removed. Both of the examinations made of the masses removed showed the growth to be a pure papilloma, without degenerate tissue of any kind being present. The patient returned to me the latter part of January, and is now, after many successful repeated efforts at removal, entirely cleared again of all growths. I simply report this case as one of the most interesting and most extensive with regard to new growth of the many cases of recurrent papillomata that has come under my observation.

I find no positive evidence to justify an opinion that the pieces of tissue from the epiglottis (or wherever they came from) are malignant. They present the appearances of epithelial papillomata, and, in places, proliferation of the surface epithelium is very marked. There are also evidences of inflammation which may be primary or secondary. Many of the papillae are infiltrated with polymorphonuclear leucocytes. There is absolutely no invasion of the underlying tissues of the epithelium. A small myxomatous area was found in one piece only. The appearances found in the sections indicated only papillomatous formations with slight inflammation.

LXXXVI.

A STATISTICAL REPORT OF THE RESULTS OF OPERATION IN SARCOMA OF THE NOSE BY METHODS GENERALLY ADOPTED, WITH A PLEA FOR THE MORE EXTENDED USE OF THE ELECTRO-CAUTERY IN SUITABLE CASES.

By J. Price-Brown, M. D.,

TORONTO.

Writers differ widely from each other in their general views in regard to this disease, and in introducing the subject a brief resumé of prevailing opinions may not be out of place.

Lennox-Browne in his voluminous work upon "Diseases of the Nose and Throat" does not even mention the existence of sarcoma of the nose.

Shurly says that myxosarcoma is the variety that occurs most frequently within the nose; and that the usual seat of growth is either the middle turbinal region or the external wall, thus granting the primary origin of the disease within the nasal cavity. He also says that while the original growth may be pedunculated, the pedicle is soon lost, the base rapidly becoming broader, until it finally loses itself in the mass of involved tissue.

Kyle, on the other hand, says that "primary sarcoma of the nose is not of frequent occurrence, but as a rule has its origin in adjacent structures, and spreads thence into the nasal cavity." He insists upon early and complete eradication as the best line of treatment, to be accomplished by the use of the curette and galvano-cautery.

Bosworth in his report of 41 cases treats of it as a primary affection, occurring in a single tumor, that may arise on the outer or inner wall of either nasal cavity. He further states that there is no clinical evidence in support of Weber's idea, that sarcoma is usually accompanied by several deposits of the same neoplasm in neighboring regions; and also, that the growth is soft and flabby, and that the tumor is invariably pedunculated.

Coakley says that sarcomatous degeneration is occasionally met with in cases of nasal polypi and other benign tumors, after these have been removed a number of times, a view which is accepted by many surgeons; and also, that the appearance of sarcoma within the nose may be the first evidence of the presence of sarcoma within the antrum. He says that the growth has a hard feel, as of solid tissue, and is not very movable even when of considerable size.

Harris, in a paper published several years ago, refers to a series of 103 cases, reported up to that date, including his own; and from the investigation of which he draws the following deductions: That round-celled and spindle-celled sarcomata are about equally frequent in their occurrence; that the cartilaginous septum is the part most frequently involved, and that next to this, the middle turbinal body; that it usually proceeds from a well-defined pedicle; that the growth is soft to touch and bleeds easily; and that "sarcoma is a small tumor, usually pedunculated, and rarely multiple." In speaking of treatment, he says that while many cases require removal by external radical operation, there are others in which an intranasal operation alone is justifiable; but that no matter how treated, more than half the cases are ultimately fatal.

Halsted believes that the period of life most susceptible to this disease is between the fortieth and the fiftieth years. His graphic description of the symptoms is worth repeating: "the conspicuous absence of pain while the disease is confined to the soft tissues; the presence of epistaxis as a prominent symptom; the nasal obstruction so great that both breathing and eating become distressing to the patient; while speech becomes difficult and the senses of smell and taste are either lost or severely impaired; until finally, as the disease advances into the accessory sinuses or the cranial cavity, pain becomes severe and continuous; and death either from sepsis or exhaustion is the result."

In order to bring the results of the investigation down to the most recent date in the preparation of this paper, I sent one hundred circulars to leading laryngologists in the United States and Canada, and as a result, I received about fifty replies. Although not by any means as satisfactory as one would like, they contain much valuable information, and I extend to the gentlemen, who forwarded the answers, my

most cordial thanks. A synopsis of these reports I here give :*

Freudenthal writes me that he must have had under observation in hospital and private practice "surely 20 cases or more." Unfortunately, he has no distinct records of them. But the percentage of permanent recoveries after intranasal operative treatment he reports as "none," and after external operations likewise as "none."

Otto Stein says that he must have seen between 12 and 20 cases of nasal sarcoma, which were treated by "various methods" with "varying results."

Thompson reports 12 cases, 9 of which were inoperable. Hence these 9, with Stein's 12 to 20, and Freudenthal's 20, are not tabulated in my present report.

Now and then, though rarely, a detailed report of a single case has been forwarded, which in itself is intensely interesting, giving at a glance a vivid picture of the whole scene. For instance, Freeman reports one that he referred to Keen for external operation. I quote his own words: "The sarcoma evidently began in the naso-antral wall and extended into the frontal sinus, antrum, ethmoid and sphenoid, by finger-like projections, but it did not seem to infiltrate the lining of these cavities, as it was easily shelled out, leaving them with the exception of the orbital plate and the naso-antral wall, practically uninjured. The incision was so extensive that the interior of all the accessory cavities on the affected side could be plainly examined. The septum was not involved, and after the operation, the eye was kept from falling into the antrum by packing. Although the operation was done eight or ten years ago, there has been no return."

Norval Pierce mentions six cases. All were treated by intranasal methods, although of what nature is not mentioned. All recurred but one, in which there was complete removal at a very early date. In this case the recovery was permanent. In two of the cases, external operations were subsequently done with only temporary benefit.

Chevalier Jackson reports eight cases. All were operated on by the external method. Two of these disappeared after-

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*A number of reports have been received since the preparation of this paper, but too late for publication. The general tenor, was the same as in those already reported.

wards, so that no trace could be made of them. But the other six all died of recurrence of the disease at varying intervals after operation.

To be definite, the following is a summary of all cases reported as operated upon, whether internally or externally, in which the patients were kept under observation until final results were obtained:

No. of Cases.	R. Nas. C. Affected.	L. Nas. C. Affected.	Both C's Affected.	Sept. Affected.	Ant. Affected.	Int. Nas. Oper.	Recurrence.	Extra Nas. Oper.	Recurrence.	Deaths.
51	22	29	9	11	27	19	13	33	25	38

In several of the above, operations were done both intranasally and extranasally.

Permanent recovery after intranasal operations, 6 out of 19, or 31 per cent.

Permanent recoveries after extranasal operations, 8 out of 33, or 24 per cent.

Total permanent recoveries after operations of whatever kind, 13 out of 51, or 27 per cent.

We must add to these the inoperable cases and those refusing operations, which presumably would all be fatal.

In one point, the consensus of opinion among authors appears to be unanimous; and that is, in the absence of pain when the soft tissues are alone affected.

Before speaking of my personal experience in the treatment of this disease, I may say that I have drawn a wide distinction in my meaning between intranasal operations and extranasal operations, all classes of intranasal operations being included in the one, the work being done through the anterior naris only and without injury to it; and in the other, all classes of external operative work done by surgical incisions through the true skin, and by this means aiming at the removal of the sarcomatous growth.

Personally, I have have had four cases under treatment. Only one of them suffered from pain within the nasal cavity. The main signs and symptoms in all four were intranasal. All were males, their ages being 18, 20, 50 and 58 years. All were subject to severe epistaxis upon very slight provocation. With one exception, there was complete blockade of the affected nasal passage. By the process of exclusion, as well as

by the signs and symptoms, the disease in three of the cases was pronounced to be sarcoma by competent medical authorities before the cases were referred to me for treatment; and in each of these, two or more distinct microscopic examinations verified that the diagnosis of sarcoma was correct. In the remaining case, histologic examinations were made at my request, and the case was pronounced a spindle-celled sarcoma. In this patient the growth.was the smallest.

Although the results in my cases have been unusually favorable, I do not give any credit to the skill of the operator, but to the method of operating—and I emphasize the latter, because the work has been principally done by the use of that much-abused instrument, the electro-cautery knife.

The first three cases were reported in the August number of the *Journal of Laryngology* in 1903. At that time eight years had elapsed since the final operation upon the first case. The case was well then, and is well now, with no recurrence whatever of the disease.

In the second case, and this was of the ʌpindle-celled variety, already referred to, occurring in a man, aged 50, the growth had been removed about a year when the case was reported. At the present time, three years later, he is still a healthy man, following his daily occupation as fireman, and free from any redevelopment of sarcoma.

The third case was the most extensive purely intranasal sarcoma that I ever saw, filling the left nasal cavity, bulging the anterior naris, flattening the nose and cheek, more than half filling the nasopharyngeal space and holding the soft palate immovably in a horizontal position. This case was referred to me in October, 1902, now four years ago; and was reported by me with the exhibition of pathologic specimens and micro-photographs at the meeting of the American Laryngological Association at Washington the following year. As, however, it was considered rather premature to report so recent a case, I again read a paper upon it, reporting progress, at the annual meeting of the same association at Atlantic City in 1905. I furthermore exhibited the patient himself, this time at the laryngological section of the British Medical Association in Toronto in August, 1906. There have been slight recurrences, at the junction of the posterior naris with the nasopharyngeal vault, up to February last; but they were always controlled by a touch of the cautery. The man is

well nourished and presents a rugged and healthy appearance. The nasal cavity is wide and free throughout its whole extent, exhibiting in some measure the great size which the growth had assumed before its removal. When required, he keeps the passage free from accumulations by the use of an oleaginous spray. His occupation is that of telegraph operator, in which he is regularly employed. He learned the art since the removal of the sarcoma four years ago.

These cases were all treated by intranasal electro-cautery operations, the parts being anesthetized by cocain. The first one, operated upon eleven years ago, was treated before the advent of adrenalin, and was attended by some terrific hemorrhages. Still the work went on with the result adready stated. In the second and the third, adrenalin was used freely and with marked advantage. In the third, however, the hemorrhages were often exceedingly severe, possibly in some instances due to a desire to remove too much at one sitting. These three men are all well, busily following their occupations in Toronto to-day.

In all these cases I believe that the growth was mainly if not entirely confined to the nasal cavity. The method of operating, particularly in the third case, was as follows:

After producing local anesthesia and anemia by the free use of cocain and adrenalin, a large tubular speculum was introduced into the nasal passage as deeply as possible; and then perpendicular incisions with the electro-cautery knife at a high degree of temperature, were made into the basal attachment of the growth on the turbinal side. They were made as deeply as possible without producing alarming hemorrhage. The moment this threatened to be severe, the operation ceased, and temporary tampons would be inserted to control the bleeding; but almost invariably these would be removed before the patient left the office.

On his return, one or two days later, the cauterized tissue would be removed either by snare or forceps, and the parts cleansed by sprays. Then anesthesia and anemia would again be induced and the operation repeated. Thus, successively, piece by piece, and day by day, with the electro-cautery blade at almost a white heat, the sarcomatous tissue would be dissected away, working gradually from before backwards, until the posterior naris would be reached; and the patient, to his delight, would be able to blow his nose through a free passage

again—something he had not done before for months, perhaps for years.

Case IV.—This, my most recent case, was referred by Drs. Carleton and Langstaff.

On August 2, 1906, the patient, a retired butcher, aged 58 years, was first seen by me. Pathologic section had already been excised and microscopically examined, and the case was pronounced one of malignant disease.

I found on examination that the left nasal cavity was filled completely from the anterior to the posterior naris with a dark red growth, dense in character, but which bled readily on being touched. I removed a section, and microscopic examination proved it to be a round-celled sarcoma.

Family History.—His father had died at the age of seventy-two years, presumably of some cerebral trouble, but on post-mortem examination, his family physician had found a hard cancer of the stomach.

Personal History.—A number of years ago, small growths, presumably polypi, had been removed from time to time from the nose; and latterly, while otherwise healthy, he had been troubled with a good deal of yellow discharge from the left nostril. This was supposed to arise from left antral disease. During the present year the left nostril had gradually closed up by the formation of the new growth; and as the cavity filled the discharge lessened. For six weeks there had been practically no discharge, but an external swelling had formed over the left nasal bone in the region of the lachrymal sac. This had been opened with a lance, giving exit to a free discharge of pus, particularly on pressure. Accumulation recurring, relief was given from time to time until I saw him—the conclusion being that the external discharge of pus was really a vicarious outlet from the closed antral cavity.

There was no particular external enlargement, but there was oppressive headache and some soreness of the nasal region. The temperature varied from 90° to 101°. Mouth breathing was compulsory, and there was a severe odor of antral disease. He had lost twenty-five pounds in weight during the last four months. The corresponding cheek was not swollen, but there was eversion of the lower eyelid, which the patient affirmed had existed for years, and was due, he said, to severe exposure during a winter storm.

After careful examination, I arrived at the conclusion that the attachment was probably to the outer wall, and that while the middle and the inferior turbinals were involved, the vault and septum might be free; and that if the antrum was affected, it would be near the middle of the nasoantral wall.

I believed also from my past experience, notwithstanding the age of the patient, that I would be justified in operating upon similar lines. To this the patient gladly assented; although at the same time, I told him of the risks of the operation, and the possibilities of non-success and recurrence of the growth.

For each operation upon the growth the patient came a mile and a half on the street cars, walked into my office, walked out again, and returned in the same way.

August 7th. After applying cocain 8 per cent and adrenalin 1 in 1000, the first operation was done as already described, the cuts being made with the electro-cautery knife at a bright red heat. The tissue was dense and hard to penetrate, but the bleeding was slight, care being taken not to cut in too deeply on this tentative occasion. Pain also was slight. Of faintness, there was none. No tampons were inserted.

August 8th. Returned to office, sloughs removed. Operation repeated.

August 9th. Exactly similar treatment with operation.

August 10th. Also similar to the previous occasion with operation.

By these four operations, the tumor, which had filled the left nasal cavity almost to the tip of the nose, had been dissected back for more than an inch, leaving the vault, septum and floor clean. On the outer wall, the front parts of the middle and inferior turbinals, which had been softened in character by the development of the disease, had been dissected away, without any appearance of recrudescence.

As I was leaving the city for a few days, the man returned to his own home, sixteen miles away, during my absence.

August 20th. Under exactly similar conditions to those already mentioned, he again came for treatment; and electro-cautery operations were done under cocain and adrenalin anesthesia as before, on August 20, 21, 22 and 23. The sloughs were taken away on the day following each operation before renewing the burning. By this time the greater part

of the middle and inferior turbinals had been removed and the patient could force air pretty freely straight through the passage. Of course, together with the removal of the sloughs daily, the cavity was freely sprayed out with an alkaline solution, washing away the debris as well as the pus, which found freer outlet from the antrum.

August 25th. On this day the last electro-cautery operation was done, burning away, so far as could be seen, the last remnants of sarcomatous tissue. The lower turbinal was entirely gone, and a large part of the middle turbinal as well. The nasoantral wall was still intact. The movements of the soft palate could be easily observed through the nasal passage, and the patient could blow out that side of the nose with much greater freedom than he could the well side.

For several days the passage was freely sprayed, and as pus was still constantly oozing from the ostium, chloroform was administered to him on August 28 at the Western Hospital, and I opened the antrum through the central part of the inferior meatus. Here the bone was soft and easily penetrated. A wide opening was made, but anterior and posterior to the site of operation the bone seemed to be of normal density. Probably at this point the osseous tissue was involved in the disease. The operation was attended with very little hemorrhage. Pus mingled with blood and some sloughing tissue were washed out and then the antrum was swabbed with peroxid of hydrogen.

After this date no further operative treatment of any kind was required. The antrum was washed out once a day with warm sterilized water, and for some days this was followed by the application again of the peroxid. Then the latter was discontinued as the condition improved. Still the nose was regularly sprayed two or three times a day with Dobelle's solution.

As the operations were comparatively painless, with little loss of blood, the cauterizations being confined to the line of sarcomatous attachment—the depressive effect of the operative treatment was slight; and for a couple of weeks subsequently, the patient seemed to rally. Then a species of malaise set in, accompanied by rise of temperature, with furred tongue, tympanites and many of the symptoms of typhoid.

The operations being over, he returned home to the care of his family physician; and as the discharge from the antrum

steadily decreased, the intervals between the washings were made longer. From this time I saw him through the kindness of his physician once a week and personally washed out the antrum. Five weeks after opening the antrum it was washed out for the last time, as pus had disappeared. There were no sloughs and the water came out of the ostium of a clear, pale, straw color. There was also no return of sarcomatous tissue —the passage being perfectly free from anterior to posterior naris.

In one way I was disappointed. The extranasal pus cavity, notwithstanding the regular antiseptic treatment it received, did not close up after the free opening of the antrum, and careful exploration by the probe failed to discover any connection between the two. Still the discharge from the external cavity gradually diminished under treatment, although it did not disappear.

When I last saw the patient, in consultation with Dr. Langstraff, seven weeks after opening the sinus, the nasal condition was the same, but he was suffering from low delirium, sordes round the teeth, and dark, heavily furred tongue. There was some effusion within the abdomen and extremities, although examination of urine showed no trace of albumin. All fever had subsided.

It seemed to be clearly a case of septic infection, possibly from absorption of ptomaines from the sarcoma, possibly from the long continued presence of pus in the antrum and facial cavity, or from both combined.

The patient died one week later, seemingly not of sarcoma, as there was no visible sarcoma present, but of sarcomatous septic infection.

Fatal although the result may be, I believe the operations as done upon this patient were both justifiable and advisable; inasmuch as while the suffering from the operations was slight, the gain in comfort to himself and friends was of a very marked character. The distressing respiration disappeared, the fullness and pressure in the face was relieved, and the progressive deformity of the nose ceased to exist. All these would have been severely and continually aggravated, while life lasted, if relief had not been obtained.

Further still, from my experience in the former cases, as well as in this one, inasmuch as the growth seemed to be en-

tirely removed, I feel confident that the intranasal operation has given greater freedom and comfort to the patient than would have been probable by external operative treatment; and the disastrous results attending the latter in advanced cases are so great, that I would not advise it in a case like this.

The advantages of intranasal operations over extranasal operations, in nasal sarcoma, in cases in which the large bones of the face are not involved, are very marked indeed; while unfortunately, the methods that can be successfully used are very limited. Of my four cases, not one was a pedunculated sarcoma when referred to me for examination. The nearest was the second case, but even in this one, the base was as broad as the growth itself. It is impossible to snare these widely attached sessile growths away. And when we try, our earliest reward is more likely to be an alarming hemorrhage than anything else. I well remember such a result in my first attempt at operation in my third case. After applying cocain and adrenalin freely, I passed a snare along the floor of the nose in the hope of grasping and removing a good sized segment to begin with. For a moment I was delighted with a successful result. A smooth oval piece of the growth as large as a pigeon's egg dropped into the bowl. For some minutes I could not examine it, as the hemorrhage was enormous, and required vigorous and tight packing to check it. When, however, I could take a look at my pathologic prize, it proved to be a large piece of gauze, which at some former time had been inserted in the nose of the patient to check a bleeding, and which had not been removed.

Neither can these large sessile growths be cut out of the nose by means of knife or scissors. When small and pedunculated no doubt they can. But as sarcoma of the nose in its early stage is painless, these cases rarely come into the hands of the specialist until they are well developed and have lost their pedunculated form. The base of the growth becomes widely sessile; and it would be simply impossible to dissect out through the narrow naris, such a hemorrhagic tumor as a sarcoma with attachment along the whole of one side of the nasal cavity from the anterior to the posterior choana.

Possibly it is for this reason that so many of these cases are referred to the general surgeon for external operation, while it would be much better, cosmetically and in every other

way, for the patient, if the rhinologist could remove the growth intranasally.

We are living in an age of brilliant operative surgery, in which the clean cut, done once and for all, is considered the operation par excellence. And it is only natural that the laryngologist should be willing and desirous to emulate his surgical brother in the accuracy and finish and finality of his work—alas for the patient, the finality is sure enough in nasal sarcoma. Leaving out the 20 cases reported in the one instance as all fatal, and the others that either disappeared or were inoperable in the list already given, there were only 13 permanent recoveries out of the remaining 51 cases—27 per cent. I fear this is the worst report that has yet been published; but I have the record over the signatures of the men who so kindly and promptly answered my questions—and all honor to them for doing so.

Granting then that the external surgical operation rarely results in permanent cure; and that internal operation, neither by knife, nor snare, nor scissors, nor curette, nor all combined, can remove successfully a large sarcoma having an extensive basic attachment; why not accept the electro-cautery knife as the instrument of excision, when by its judicious and patient and regularly repeated use, the work can be successfully and safely accomplished, for the time at least? Not only can this be done; but by the removal of the sarcoma in this way, we have the additional advantage, over an external operation, of retaining a wide patulous nasal cavity, through which the growth can again be attacked and destroyed if recurrence should take place.

The claim I make is, that inasmuch as a large majority of the cases of nasal sarcoma originate in the soft tissues of the nose—even Freeman's case described so graphically, illustrates this point—they can at any time be operated upon with the electro-cautery, provided the bony framework of the nose has not become affected with the disease. That in many of these cases a cure can be accomplished by thorough and careful and painstaking treatment; and that even in cases usually considered inoperable, great and beneficial relief can in some cases be secured to the patient by the same means.

LXXXVII.

TWO CASES OF STAMMERING, ILLUSTRATING THE IMPORTANCE OF EARLY TREATMENT.*

By G. Hudson-Makuen, M. D.,

Professor of defects of speech in the Philadelphia Poly-
clinic Hospital and College for
Graduates in Medicine.

At a recent section meeting of this society, in Syracuse, I
had the pleasure of outlining a plan of treatment for stam-
mering, and I now desire merely, as a supplement to that pa-
per, to report two cases, illustrating the results of the treat-
ment, one of which was successful and the other only partially
so. I desire also to point out that the comparative failure in
the one case was due, among other things, to the fact that the
habit had become more deeply rooted, and that as a conse-
quence there had arisen in the mind of the patient an almost
ineradicable idea which seemed to be directly opposed to nor-
mal speech. This idea had the fixedness of those often found
in hysteria, and it was strongly suggestive of that disease.

The patient was 10 years of age. His elder brother stam-
mered, and several other children in the family had some
lesser peculiarity of speech. He had had measles, croup,
whooping-cough and bronchitis. Adenoids were removed in
infancy by Dr. T. H. Halsted. He still takes cold easily, and
has some catarrhal droppings in the throat. There is a his-
tory of consumption on the mother's side, and he inherits a
nervous disposition. He is bright intellectually, but abulic
and amnestic. He cannot will to do things, and he forgets.
He is specially lacking in the control of his muscles, and the
development of the kinesthetic memories for their action and
co-ordination in speech, is extremely slow. His favorite ex-
pression is "I don't know," and he is never unable to say it.
When called upon to recite something voluntarily, however,

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*Read before the American Laryngological, Rhinological and
Otological Society, at Kansas City, Mo., June 12, 1906.

he grows pale and loses control of his voice entirely. He has been under treatment for a little more than two months, and although the improvement is very great, many more months may be required to complete a cure.

The other one is the son of a physician in Pennsylvania. He was two and a third years of age when brought to me by his father and mother. He began to talk very early, and he was developing a severe form of stammering. He was also of a nervous disposition, but I could elicit no history of a similar affection in either his immediate or remote ancestry. He had been for a single day with a child that stammered very badly, and thus may have caught the affection. In the course of a half hour's conversation with the father, a plan of home treatment was suggested which resulted in a complete cure of the stammering, and the entire removal of the vicious tendency in a very short time. On May 11th, thirteen months after my first consultation, I received the following letter from his father, Dr. L. S. Walton: "Dear Dr. Makuen: I would say in regard to my little boy, that when he began to talk he stammered so badly that it was impossible to understand him. At times he would clasp his hand over his mouth and say, 'Cannot talk.' After consulting you, I began at once to follow your instructions. We noticed an improvement in a very short time, and at the end of four months, very much to our relief, he was entirely cured. One year has passed, and he now talks fluently. Please accept my sincere thanks, etc."

A question often arises, "What is the best time to begin the treatment of stammering?" and I have said somewhere, that the best time to cure stammering is before it begins, and that if all children showing a tendency to the affection could have the proper management at the very beginning, the great majority of them would never acquire the pernicious and distressing habit.

The two cases above reported seem to present good illustrations of this fact. The first patient had acquired the habit of stammering, and having inherited a nervous temperament, he presented unusual complications, while in the second no such psychic conditions were present. There was only the beginning of a disturbance in the centers of co-ordination. The child was beginning to evolve ideas more rapidly than he could express them. His attempts at speaking were similar in all respects to water gurgling out of a small bottle. His

words were literally tumbling over one another, and he only required a little help in the co-ordination of the processes of the manufacture and the delivery of them.

The home treatment for beginners in stammering is one that may be carried out by any intelligent parent. The child is always of the so-called nervous temperament, and he usually inherits some peculiarity of speech. If it is not found among his immediate ancestors it may often be traced to a former generation. It may not be sufficiently marked as to amount to actual stammering. It is often only a very blustering form of speech. In tracing the cause in individual cases of stammering, it is not an unusual thing to find the father or mother to be a very rapid talker. Thus the question of imitation comes in and complicates that of inheritance. The two factors combine in many instances as if to make sure of their victim. The child inherits a tendency to faulty speech; he hears faulty speech about him, and, speech being acquired solely by imitation, his only recourse seems to be to hesitate, and finally to stammer.

The diet for such children should be simple and nutritious. The patient should spend from a half to three-quarters of every twenty-four hours in bed. All disturbing influences and exciting amusements should be interdicted. Under no circumstances should any kind of talking be allowed during periods of emotional excitement. A systematic course of calisthenics should be instituted, and especially those free movements that tend to develop the respiratory organs. Breathing exercises should form a vart of this course, and the child should be drilled in the proper methods of forced expirations, such as are used in crying, laughing, hallooing. The diaphragm and abdominal muscles should be trained to perform their part in vocalization, and for this purpose, phonetic and syllabic speech should be practiced.

LXXXVIII.

VIOLENT EPISTAXIS IN A GOUTY PATIENT.*

By Prof. A. Trifiletti,

NAPLES.

Among the numerous and varied relations of spontaneous epistaxis to certain general morbid conditions, that to the arthritic diathesis or its gouty manifestations has already been brought out by writers, but perhaps too indefinitely.

I am permitted to report the history of a case of this sort recently observed, in which this relationship appears to me to be positive.

The patient was a woman, aged 50 years or thereabout, obese, anemic and at the same time rheumatic or susceptible to rheumatism of a maximum degree. She led a sedentary life at home, complaining almost continually of pain and suffering in various parts of the body, but especially in the region of the tarsal and metatarsal, phalangeal and metacarpal articulations, etc., which at present are a little enlarged and painful and covered with edematous skin, but without any true gouty deposits.

The patient, in spite of her age and her adipose and anemic state, still had her menses, which, however, were rather abundant, there being nearly always a metrorrhagia. Her father, aged about 80, is still well. Her mother died recently but without any arthritic diathesis. There is no other hereditary complaint. In fact, the patient had not suffered from anything else than malaria, having lived in her youth in a swampy place, but the chills had not recurred. She has been subject to slight attacks of bronchial catarrh, of which she still has signs.

It was during one of these attacks on the evening of April 9th last, that the patient began to bleed violently from the left naris. Her menses, then in progress, stopped. The epistaxis, with varying severity, in spite of the hemostatic means employed, persisted all night, and next morning the local physi-

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*Translated by Albert Miller, A. B., M. D.

cians did the classic antero-posterior tamponnement of the nasal fossa, with much discomfort to the patient. Nevertheless, at varying intervals there were renewed hemorrhages from the fossa, escaping through either the anterior or posterior tampon, or even the naris of the opposite side (right). The patient felt prodromes of the hemorrhages; she had formication of the skin, blood rushed to her head, her feet became cold, and then the flow began.

This continued for four or five days, making the patient more and more anemic, when I was called to see her and to suggest a more effective remedy for the epistaxis.

Having learned the history, and the somatic conditions of the patient, and that the tampon was well in place, I thought that the latter was insufficient in view of the violence of the hemorrhage (aside from its intolerance, which I thought could be remedied by tamponing with a long strip of iodoform gauze, as is done by rhinologists). However, I did not wish to advance any definite opinion before a local observation, so I took advantage of a temporary cessation of the blood flow to remove the tampons and clots.

The result of my examination and the course of the case for about 24 hours are as follows:

Rhinoscopy showed much congestion of the Schneiderian membrane, especially on the left side, increased by the presence of clots. Nasal cavities large, as in atrophic rhinitis, permitting a view of the posterior wall of the pharynx, which was similarly congested but free of morbid products. There was an absence of pathologic secretions, varicosities and circumscribed swellings, etc. The mucosa bled easily, especially upon the septum and floor, even simply by wiping or passing the cotton carrier over it with a view of discovering the bleeding point or points. However, I could not distinguish any, for entire portions of the mucosa bled *en bloc* (hemorrhage *a nappe*). The pharyngeal vault vault remained clear.

As to the clinical course of the epistaxis, I noted plainly that it was of a recurrent form with attacks occurring every 3 to 6 hours or longer (once the patient had gone without a tampon an entire night). The attacks were always copious, violent, and difficult to stop.

As to the utility of tamponing with iodoform gauze, which I prefer (aside from its tolerance, asepticity, etc.), it must be

confessed that in some exceptional cases, such as the present, it is not better than the classic tamponade.

It is to be remarked here that when the tampon was tight in front the blood flowed out posteriorly, and vice versa, which unequivocally shows the origin of the epistaxis in this case. Fortunately, little by little, the hemorrhagic tendency began to decline spontaneously, and then any means, including adrenalin, etc., appeared to be very good for the purpose.

The epistaxis, then, was not fully explained by local conditions except as a *locus minoris resistentiae*. It is also true that from the beginning it was very copious and sudden.

Now, this brings us to another part of our research, not the bronchial catarrh which was rather a small matter, nor the spleen which was almost normal (this with regard to a latent malaria with epistaxis), nor the cardio-vascular examination, which showed simply a slight arterio-sclerosis,* but the dyscrasia, as shown by an examination of the urine. This was done by Prof. V. Gianturco, April 19, 1906, and gave the following result:

Physical Character.—Slightly cloudy, yellow amber color, acid reaction, specific gravity 1025.

Microscopic and Bacteriologic Examination.—The residue upon the filter, examined microscopically, showed: Several mucus corpuscles, very numerous pavement epithelial cells, a few decolorized red corpuscles, several particles of urate of soda, a few crystals of calcium oxalate, a few waxy casts and some cylindroids.

Normal Pathologic and Accidental Chemical Constituents.—Of the normal constituents, the urea (gr. 29 per litre), the urates, the oxalates and the alkaline and earthy phosphates are increased slightly. Indoxyl and skatoxyl sulphate are trebled in proportion. The other normal constituents, such as creatinin, oxaluric bases, pigments, sulphates and chlorides, are in usual amount. Albumin in small traces, not over 5 centigrams per litre. Absence of sugar and every other pathologic constituent.

In contrast, notice the following analysis, made August 15,

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*These observations have been confirmed by different clinicians who visited the patient after myself, especially Prof. G. Bolucci, who insisted upon the possibility of gouty kidney, which will be discussed further on.

1906, four months after the attack: Urine slightly cloudy, pale yellow color, acid reaction, specific gravity lowered to 1018. Several mucus corpuscles and epithelial cells, mostly pavement. No casts visible. Of the normal constituents, the indoxyl and skatoxyl sulphates have quadrupled; oxalates slightly increased. The other normal elements, such as urea (grs. 19 to the litre) are in usual proportion. Albumin persists as a trace.

<center>REMARKS.</center>

In these urine examinations (although the first was made on the tenth day of the epistaxis, the patient being on milk diet) every clinician will read the uric acid diathesis and the possibility of gouty kidney.

Without going into the details of these diseases, which would lead us into foreign fields, I cannot avoid associating the foreign epistaxis of this patient with the arthritic, or more properly uremic, attack. Considering the patient as gouty, we must admit the possibility of various vasomotor troubles and unwonted vascular pressure, hence the hemorrhage. From this viewpoint, we could also link the epistaxis with vascular disorders inherent to the menopause, and speak of it as a vicarious epistaxis, or, according to some writers, neuropathic (Türck).

But my first conception was confirmed by the following circumstance: Hardly had the tendency to epitaxis disappeared, 17 to 20 days afterward, when the patient was attacked first in the fingers of the left hand and then in the arm, with severe pains accompanied by edema of the skin. These were not relieved by general or local treatment, but ceased spontaneously in about 20 days, without any febrile movement to note, or any suppuration.

This should be interpreted as a true arthritic attack, or anomalous gout, which throws light upon the preceding epistaxis.

In conclusion, I have not pretended to advance a new cause for spontaneous epistaxis—still less to affirm that here the epistaxis was a gouty manifestation—but have simply desired to clear up the bond, already admitted by writers, existing between epistaxis and certain diathetic states.

LXXXIX.

THE IMPORTANCE OF DISEASES OF THE NOSE IN TREATMENT OF THE SO-CALLED SCROFULOUS DISEASES OF THE EYE.*

BY DR. C. ZIEM,

DANZIG.

Many diseases previously known as scrofulous are now ascribed to tuberculosis, especially those ocular diseases of children characterized by a supposedly essential stubbornness and lasting for years, such as diseases of the lid margins, conjunctiva, cornea and sclera and, according to many authors, even of the iris. Yet the progress achieved in ophthalmology by this shift is not great, since the localization of tubercular virus or bacilli in the eye is very seldom established, but the patients after they have been treated by proper local and general treatment, which need not always nor even occasionally be antitubercular, for years and even decades, remain free from any fresh scrofular, tubercular or pseudotubercular disease of the eye. A much larger number of "scrofular" diseases of the eye must rather be considered due to:

(1) Malaria, a very characteristic example of which can be quoted from the fourteenth century, in the Decameron of Boccaccio, a writer of rare medical knowledge. In the description of the maid Ciuta (VIII, 4) are the words: "ella aveva il naso schiacciato forte e la bossa torta e le labbia grosse e i denta mal composti e grandi e sentiva del guercio, ne mai era senza mal d'occhi, con un color verde e giallo, che pareva che non a Fiesole ma a Sinigaglia avesse fatta la state: e oltro a tutto questo sciancata et un poco monca del lato destro,"[1] * * * * to which the publisher, Fanfani, adds the statement that Fiesole lies on a mountain with very

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*Translated by Clarence Loeb, A. M., M. D.

pure air, while Sinigaglia lies in una regione di ara malsana (in a region where the air is unhealthy.)[2]

(2) A disease similar to malaria, accompanied by hypertrophy of the spleen (Herm Weber, Gerhardt, Friedreich, Oppenheimer, etc.), which is caused by the influence of gloomy cellars, the moisture from damp floors of rooms, modern wall fillings, etc., and is very frequent in houses built on swampy ground, such as is the case in Danzig.

(3) Influenza, measles, scarlatina, chicken-pox and other infectious diseases which appear first on the mucous membrane of the nose and are accompanied by fever and pus formation. These diseases extend from the nose—

(a) Upwards, either by continuity along the mucous membrane, the nasal duct and conjunctiva, or through the blood and lymph vessels to the eye;

(b) Downwards to the larynx and lungs, giving rise to chronic destructive diseases or localization of the bacilli themselves (Piorry, Alexander, etc.) ; or

(c) In other corresponding directions, leading to suppuration of the middle ear, hypertrophy of the lips, eczema of the cheeks, pseudoscrofular hypertrophy of the submaxillary lymph nodes (Velpeau, Griesinger, v. Tröltseh[3]), while such a hypertrophy in other cases is usually caused by diseases of the teeth, according to Stark, Partsch, Hans Körner, etc.

The relationship of the primary disease of the nose with the secondary disease of the eye, or as Schmiegelow[4] puts it, "the rhinogenic nature of many diseases of the eye, especially the 'scrofular' " was more or less well known by older authors, not specialists in the narrow sense of the word, such as G. A. Richter, J. v. Hasner, Vésigné, Gensoul, W. Roser, Zehender, Horner, Ed. Meyer, Adolf Weber, etc. Especially the later view, that "scrofular" eczema of the cheek may cause disease of the eye by the transference of purulent secretion by means of the finger, does not hold good, in addition to other reasons, because it can be proven that adults with febrile eczema of the cheeks and scalp and purulent catarrh of the eyes and nose do not acquire the eye disease in this way, and because a cure can be obtained in a short time by proper treatment of the eyes and nose and correct general treatment, without any local treatment of the cheeks themselves.

The ophthalmology of the present fails in the case of these diseases—

A. On account of too energetic local treatment of the nose.

B. On account of neglecting a systematic treatment of the nose, nasopharynx and pharynx.

C. On account of neglect of fever which is often present.

A.—I believe that the first thing to be done in scrofular disease of the eye, in order to bring about the most favorable conditions of curing, is the regular cleansing of the nose by means of large amounts of a nonirritating fluid, i. e., physiologic salt solution, and a lavage of the conjunctival sac by means of a de Wecker power irrigator, or, better still, is the continuous stream of an air-tight force pump, because, according to my published experiments,[5] it is more active and quicker and more easily regulated as to pressure in cases of corneal ulcers, etc. An interrupted, jerky stream is very unpleasant on the eye and, as seen lately by me in a well observed case, it may cause disturbances in the functions of the retina by its blows. Even children of 5 years can be easily treated, especially after demonstration on some other child; those still younger are held on the mother's lap or an operating table with the head turned somewhat to the right or left. This lavage is very important in the frequent dust conjunctivitis or keratitis caused by fine dust, glass dust, sawdust and especially sand in forestless or deforested places with frequent sand storms, such as East Prussia, near Marsailles, the highlands of Spain, South Russia, Hungary, Egypt, South Africa, etc. If the fine dust granules remain in the sac, they may cause distinct trachoma-like swelling of the conjunctiva, often considered "scrofular," occasionally only of one upper lid, or vascular and even purulent keratitis, a very distinct case of which I reported six years ago[6]. Cold applications are often injurious to diseased eyes, often calling forth a nasal catarrh when it is not already present; lukewarm applications are better in conjunctivitis, and warm applications are indicated in single and purulent iritis. Atropin, which Adolf Weber discarded in 1877 for corneal ulcers, is indicated only in iritis, but even then, in fever following influenza, is often injurious, probably by preventing the very important secretion of sweat[7]. Among the few patients whose eyes became worse while under my treatment, I must always

rank two persons who suffered from influenza and hypopyon
keratitis, and who after repeated instillations of atropin, rap-
idly became worse, one eye, or rather both eyes, being lost. In
spite of the opinion of Horner and others who agree with
him, I agree with Professor Hess[8], of Würzburg, that atro-
pin is not indicated in photophobia following scrofular kera-
titis, and has been discarded in ulcers of the cornea by veter-
inary ophthalmologists on account of the permanent scar.[9] The
yellow salve which is so frequently used for dust conjuncti-
vitis, and which is considered almost a panacea, but concern-
ing whose healing powers Professor Hess seems to have some
doubts, has not been used by me in my practice for more
than twenty years. Frequent slitting and probing of the tear
passages, opposed thirteen years ago by Terson of Toulouse,
and later by different Italian writers, especially Guaita, Cir-
incione and Fumagelli,[10] is actually very seldom necessary
when the nose is correctly treated. J. Hirschberg has re-
cently reported several cases of concretions in the canaliculi
or of atresia of the ostium nasale treated without benefit
where probing or perforation from the nose was not to be
recommended: e. g., W.—Lachrymation on both sides, slitting
the canaliculi by Dr. N. Probing, no result. Sewed to-
gether by Dr. N. N. Conjunctival instillations, no result.
Lavage of the eye and the catarrhal nose with salt water by
me, complete cure since the fall of 1904. Even the injection
of plain water through the canaliculus, which Zehender claims
will cure nineteen out of twenty of all acute cases,[11] is un-
necessary in the great majority of cases when the nose is
correctly treated, sometimes only syringing of the nose with
saline solution being necessary. I, myself, before the open-
ing of my purulent right antrum in 1883 suffered from epi-
phora of the right side; since then, spontaneous cure. The
same thing happened in a case described by me in 1886[12]. Of
course, every case of dacryocystitis is not accompanied by a
suppuration of the corresponding antrum, although Kuhnt
found them so often together that he advises, and with per-
fect right, that the most careful search be made for a maxillary
empyema in such cases[13]. In 1895, however, I reported a
case where there were distinct bulging of the tear sac,
suppuration of the nose, absence of the corresponding first up-
per molar, complete darkness of the maxillary region in trans-

illumination and complete absence of any subjective sensation of light, and yet, when the antrum was opened through the alveolar process and syringed, no suppuration of the sinus was present[14]. On account of the close vicinity of the antrum to the nasal duct, which is well shown in the drawings of frontal, horizontal and sagittal sections of the head by Sömmering[15], Henle[16], Merkel[17], B. Fraenkel[18], Zuckerkandl[19], Spalteholz[20] and Toldt[21], the extension of a suppuration of the sinus to the ductus lacrymalis is easily possible, even without the presence of a true fistula, a fistula duct. lacrym. intern., which F. v. Hasner[22] observed on a cadaver in 1850, in a medullary sarcoma of the sinus, and which seemed to be present in a case of empyema of the antrum, reported in 1885 by J. v. Michel[23], where, on blowing the nose, the whole conjunctival sac was flooded with pus. Of course, it would have been better to confirm the diagnosis by injecting a colored fluid into the sinus, since in a case, observed by me, of abscess of the orbit and fistula of the tear sac accompanying empyema of the antrum, the venous stasis caused by the pressure forced pus not out of the antrum but out of the orbit.[24] Participation of the ductus and saccus lacrymalis in suppuraration of the frontal sinus was seen only once by Kuhnt[25] up to 1895, yet a case of that kind, an "ozena a tipo frontal-ethmoidale anteriore, una vera miniera di insegnamenti etiologici patologici e terapeutici," was reported at length from the clinic of Toti[26]. In acute dacryocystitis, in addition to proper treatment of the nose, there is to be used local warmth, or something which has been used by me for years in abscesses and diseases of bones elsewhere in the body, and which has lately been recommended by others, viz., a vesicatory, e. g., emplastr. camph. fusc. extens., whereupon the swelling frequently disappears of itself. Otherwise, incision and expression of the abscess and application of a plaster, which is perforated in many places and frequently renewed for aiding the evacuation of the abscess are necessary. But why the extirpation of the tear sac in relapses, which in the practice of many has run into thousands and has even become a kind of sport, whereas the cause apparently lies in the nose, which, in most cases, has not been examined: e. g., there is the case of severe suppuration of the nose seen by me ten years ago, where someone had extirpated the tear sac with-

out affecting the epiphora, whereas, in the case of the tube-maker B, of this place, after someone had proposed ex-tirpation of the tear sac, regular lavage of the nose and conjunctival sac, carried out for weeks, and application of leeches in the retrolobular region, had relieved the purulent dacryocystitis to such an extent that the number of times the eyes had to be wiped had been reduced from once every half hour to once a day. Then there is the case of the dock-hand B, who formerly had to empty his purulent tear sac every five minutes, but who, because of similar treatment, has been com-pletely cured for three years. Similar results are to be ob-tained in many cases, even without extirpation of the tear sac, without the treatment recommended by Gatteschi,[28] viz., removal of the middle turbinate with curetting of the eth-moid, or without the method frequently used by Wolhouse, which extends all the way back to Galen[29], and which has been used in an improved form by Toti[30], viz., the formation of a tear sac-nasal fistula (dacryocystotomy) or Laugier's tear sac-antrum fistula, in regard to which Hyatt has re-marked that it was not clear how the hole in the bone was to be kept open long enough.[31] Now, in the twenty-five pa-tients operated on by Toti, where in addition to the lachrymal bone the inner half of the lachrymal sac was removed, a cicatrization of the fistula has so far taken place only in one, case 7, a child of 5 years. Perhaps, on longer observa-tion, this will take place in other cases also, for of the twen-ty-five cases, four were not over 6 years old, nine not over 10 years, thirteen not over 15 and sixteen not over 18 years, whereas the power of regeneration still exists. Callus forma-tion in so young an age is naturally very extensive. Other-wise, it cannot be denied that Toti's results were very rapid; still a careful treatment of the nose, as noted above, combined with a thorough blood-letting from the lower turbinate, would have made a more extensive operation in a number of these cases unnecessary. Furthermore, in several cases, especially 1 and 2, Toti ordered "abbondanti lavaggi nasali per la forma ozenatosa" of the disease. At least, the author has the credit of preventing unnecessary extirpation of the tear sac from without, and of devising for severe cases a rhinosurgical method which is at least sometimes effectual.

Away with the scharp curettes which Möller[32] has discard-

ed even for animals (dogs), and the galvanocautery in ulcers of the cornea, even the ulcus serpens with or without hypopyon, which is so often found with "scrofular" nasal suppuration, and which probably has a febrile origin and should be so treated; e. g., P. ulcus serpens, purulent nasal catarh, influenza; February 22, 1904, vision=4/24; lavage of eye and nose, warmth, dressing, fever treatment (v. later), ambulatory treatment; February 17, 1905, vision=4/9. Away with the unnecessary and even harmful iridectomy, so often seen by me in the practice of others, for central scar of the cornea, for the vision in such cases can be increased in a much simpler way, e. g., as in the following case: B, 40 years old, treated more than twenty years before for scrofular keratitis, had a central scar of the cornea and a vision of only 4/24 on October 9, 1904, but after two lavages of the nose and applications of two leeches to the postauricular region, the vision on October 20 was 4/12, naturally not because of any clearing up of the old scar, but rather because of curing of a hyperemia of the choroid, which had probably existed for some time and which was secondary to a nasal condition. In orbital or paraorbital abscesses, attention to nose and teeth is strangely neglected, as I lately saw in a 5-year-old girl, who suffered from fever after influenza, and from suppuration of the nose, and who had been treated by a specialist only by daily expression of the abscess, but whom I quickly cured.

Even the rhinogenic nature, so often apparent, of osteitis orbitalis was not mentioned by Schmidt Rimpler[33] last year, in spite of the articles of Ziem,[34] Panas (1894), and others, and yet more can be accomplished in such cases, especially when the abscess is deep, by local vesicatory plasters, sojourn in a garden or forest and treatment of the nose, than by too early incision and a depleting bleeding. Away, also, with the heating flannel bandage, very much in evidence in Danzig ten years ago, which is useful even in policlinic treatment only in severe cold, and substitute the light gauze bandage, which can be removed at night in most diseases of the eye, even in many traumata.

B.—Treatment of the Nose.

In spite of the present view of many, lavage of the nose with physiologic salt solution by an air-tight pump is of

great importance in many diseases. The entrance of the water
with its mucus or pus contents into the middle ear, so much
feared, takes place only when (a) water is forced into the
ear by a pump or syringe which does not give a continual
stream, and (b) when a counter-opening is present, i. e., a
perforation of the drum, through which the air in the mid-
dle ear is forced out. When Lichtwitz[35] states that O.
Brieger saw with his own eye, water squirted into the nose
come out of a "ancienne et large perforation du tympan"
(old, large perforation of the drum), I can say that the
same has often been observed in my practice, but never have
I deduced from that, that in an entirely different hydrostatic
condition, i. e., where the drum is intact, water could be
forced into the ear by means of an air-tight pump.

Under the two conditions named, the water, during the
syringing of the nose, will rather not and cannot enter the
ear. (1) For the tuba Eustachii is not a wide canal, as many
believe from anatomic specimens which, be they ever so clever,
are after all reconstructed dissected specimens, e. g., Fig.
996 and 997 of the anatomic atlas of Heitzmann-Zucker-
kandl[36], but as shown on frozen cadavers and heads sawed
through in toto, such as the classic drawings of W. Braune[37]
in the Handbuch der Rhinologie und Otologie, partially, also,
those of B. Fraenkel[38], Zuckerkandl[39] and Toldt[40], it is a
narrow slit into which water can penetrate during syring-
ing of the nose only after the air is removed from the middle
ear. A similar condition to this was found lately by Menzel
for the frontal sinus, when on injecting water into the an-
trum, it will enter only when there is a counter-opening in the
forehead.[41] (2) Even after introduction of the catheter into the
tube in living people, water cannot be forced into a healthy
ear by means of an air-tight pump (Zeim[42]). (3) Even dur-
ing swallowing the drops of fluid found in the ostium tubæ
do not enter an ear whose drum is non-perforated (A.
Lucae[43], J. Gruber[44] and Nicaladoni). (4) Just as little
does it take place when the patient swallows while the nose
is being syringed, as I stated before and as I have lately
demonstrated on a number of persons. (5) Even when the
nasopharynx is syringed with a curved tube and an air-tight
pump, water does not enter the middle ear when the drum
is intact, as Schwartze and Lennox-Browne[45] have noticed.

Also, as I desire to add, not when the patient swallows during this procedure, which many can do.

It could be theoretically supposed—of course, I have not tested it experimentally—that during syringing of the nose anteriorly or posteriorly, water would enter the ear during a false swallow with subsequent cough and insufficient closure of the nasopharynx by a slowly functionating or paretic velum, or if the external nares were held closed at the time, causing the soft palate to sink; the greatest care must be taken to prevent false swallows and cough during the lavage. Although it would be possible to cause drowning by forcible, careless pumping of water into the nose of a man who was forcibly held, no one would for this reason discard lavage of the nose for therapeutic purposes.

That, after lavage of nose, fluid can be forced into the ear by blowing through the nose, and almost all cases of entrance of fluid are to be explained in that way, has been clearly shown by Guye.[46] Just as self-evident is the refraining from cold injection fluids as well as going out into the fresh air or standing at an open window before ten to fifteen minutes have passed, otherwise colds and headaches are easily acquired.

After all has been said, I still believe, in spite of the remonstrances, rising even to personal attacks, of M. Bresgen[47], that lavage of the nose with a physiologic salt solution and an air-tight pump is a very good healing agent, especially in "scrofular" diseases of the eye and nose.

Children can almost always be persuaded to bend forward, open their mouths and let the treatment be carried out. Very small children are held horizontally over a bucket or the like and are lavaged, having care that they do not swallow and get water into the ear, the larynx or the trachea. If they cry forcibly, it is so much the better, since the closure of the nasopharynx is so much the firmer.

There are straight, delicate or thick tubes, with perforations in the sides, for introduction deep into the nose and lavage of its upper part, and nasopharyngeal tubes which, in contrast to Courtade[48], I would not discard, since after lavage of the nose anteriorly a subsequent lavage of the nasopharynx frequently removes a very large amount of pus. That use of water causes headache was known long before Bresgen.

Tavel's salt-soda solution is not pleasant nor are injections of milk or camomile tea, while in use of carbolic acid, alum or zinc, lasting disturbance in the olfactory power have been observed (cf. Lichtwitz 1. c.). Borax and broic acid finally attack the heart. Doubtful water is to be boiled.

This lavage with salt water acts, contrary to the belief of some, not only by purification but also, as might have been deduced from the salty condition of the ocean, by attacking the pus and filth, and by furthering the lymphatic and venous circulation in the neighboring organ, apparently to a considerable extent, as can be seen from the following facts: the clearing up of the forehead which frequently takes place at once, the increase in vision claimed by the patient but not objectively demonstrable, the easier nasal breathing, and as so often seen by me in angina, easier swallowing, the increase of saliva which often follows, but whose genesis is not yet explained, etc. Furthermore, many children at once open the lids, which had been convulsively pressed together, after lavage of the nose, even without it being necessary to follow the advice of Jüngken, A. v. Gräfe and Schmidt-Rimpler, viz., to plunge the head suddenly into a vessel of cold water, a rough, not uninjurious method and one certainly hard to repeat on the same child. In many patients who originally consulted me for nose or ear and not eye trouble, I have often seen a distinct and permanent paling of a conjunctiva, formerly chronically reddened, after simple lavage of the nose without any local treatment. Some patients with acute ocular catarrh were treated *experimenti causa*, also, only by lavage of the nose with salt water, frequently resulting in a quick disappearance of the ocular catarrh. Furthermore, there are numerous patients treated elsewhere, only with local treatment for the eyes, whom I have cured by combined treatment of the eyes and nose; e. g., in 1902, a 6-year-old girl, who had been treated elsewhere for six months without the slightest benefit, was cured in a few days and has remained well since; in January, 1903, a young laborer who had suffered from agglutination of the lids in the morning, in spite of a five weeks' "clinical" treatment; in 1893, a 17-year-old girl, who, for three years had been treated clinically for recurring, "scrofular" keratitis, and who had had an iridectomy performed for opacity of the

cornea, but who had been discharged uncured. She was my assistant for a long time but later on married, and has remained healthy to this day. On the 16th of this December, there came under my treatment a 17-year-old girl who, from April to June, 1905, eight weeks, had been "clinically" treated with atropin and yellow ointment, likewise from October 21, 1905, to January 27, 1906, fourteen weeks, and again last June for nine weeks with cocain and yellow salve, by another oculist—on September 16, the vision of left eye $=4/60$, there were numerous fresh infiltrations and old scars of the cornea and purulent catarrh of the nose, which had never been treated; lavage of eyes and nose, cataplasm, gauze-cotton dressing, raspberry wine (cf. later). The result on the 22nd was already 4/18, and on 29th she was able to work.

The results which I obtained in the method described of treating the nose in diseases of the eye do not seem to be accomplished by other means, or at least uncommonly, especially by the method, lately recommended, of occasionally wiping out of the nose with cotton sponges or a brush moistened with a sublimate solution. Nor does the method of blowing in powders, which stop up the nose at once, or menthol, which does it later on, which in the following case, seen by me, acted in an almost incredibly injurious manner: F., pupil, in spite of absence of any subjective complaint as to his eyes, was constrained by an oculist to submit to be treated for infectious ocular catarrh by cauterizations. Then, on account of getting steadily worse, was treated with insufflation of powder into the nose by the rhinologist N. N. The condition grew still worse, and finally an operation was performed on one eye (iridectomy) by the oculists N. and N. N., resulting in phthisis bulbi. Some years later accidentally seeing the patient, a glazier's assistant, I syringed out his nose a couple of times, whereupon he stated that his head and ocular stump felt better than for years. The eyes are not helped by tamponing the antrum with iodoform gauze (Fehr, Hirschberg and Adler[49]) and the like, something which I have never done nor recommended since, instead of a broadening of a contracted field of vision, one would rather expect a further contraction on account of intoxication. Nor does the blowing of air into the nose help (Courtade, Vohsen).

Ocular conditions, furthermore, are not aided by galvano-cautery of the swollen mucous membrane of the nose, which I have not used for fifteen years, and which in most diseases of the eyes acts much more injuriously than beneficially[50], all of which I can prove, and ask that my remarks be tested.

In regard to the communications of Prof. Schmidt-Rimpler in Halle on the importance of nasal diseases in ophthalmology, that of 225 trachoma cases in his clinic, 128 were not found by the late Prof. Grunert to have any pathologic condition in the nose, it must be noted, 1st, that it does not appear whether the test lavage of the nasal cavity, so often stated by me to be indispensable, was made or not. 2nd, that Prof. Schmidt-Rimpler unfortunately seems to have forgotten my articles on the frequent occurrence of trachoma with nasal diseases, which has been confirmed by Prof. Fuchs of Vienna, Prof. Kuhnt of Königsberg, Prof. Galezowski of Paris and Schmidt-Rimpler's own pupil, Prof. Hoppe of Elberfeldt[52], who found an "astonishing" number of cases of "foul ozena" complicating trachoma, in East Prussia, whereas the further demonstration of this relationship is of the greatest importance in the study of "scrofular" ophthalmia.

Here, also, belongs careful attention to primary disease of the teeth, which is a very frequent, though often unrecognized cause of nasal trouble, as recently seen in a woman treated for two years in W.; i. e., caries of the teeth, periostitis, abscess of the root, filling of the teeth and remnants of teeth; also, the test lavage of the antrum through the alveolar process, and of the frontal sinus from without, with proper treatment of the affected sinus, as often as possible without the resection of the walls made by many entirely unnecessarily and as a sort of a routine. Many patients who have unfavorable dwelling conditions such as on the Herz mountain near Zittau, have been cured by resection of the walls or floors of their dwellings. Also, the removal of deflections of the septum, nasal polypi and adenoid vegetations, so often the cause of the eyes remaining open during sleep, provided there is no fever and the lavage of the occasionally suppurating nose[53], combined with the internal administration of weak iodin preparations, recommend-

ed by French authors, are ineffectual. Furthermore, the removal of palatal tonsils, which, however, is not always necessary, following which I have seen, as in several cases described in 1886, a distinct improvement[54] and even cure of a "scrofular" eye that had been treated for relapses for seven years, without results. Then, too, the cure of the cleft palate, causing nasal trouble (Alt, Toronto[55]), etc. Furthermore, in spite of the opposing views of many as an "unnecessary" bother, the us of good (English) leeches behind the ear in the regio retrolobularis for the purpose of depletion, since only there can the lymph vessels of the back part of the nose and of the orbit and bulb be attacked (Ziem[56]). Care in preventing cutting and washing of the hair during the existence of an eye disease, or shortly thereafter, for an accentuated nasal catarrh often causes an increase in the disease or a new attack of an almost healed ocular disease; likewise entering unheated churches, the use of cold footbaths in cases of habitual cold feet, and finally in spite of the contrary advice of John Locke, the avoidance of damp shoes, etc., and the wearing of rubber shoes when sitting for a long time in school, etc.

C. Scrofular diseases of the eye are often accompanied by symptoms of fever, a fundamental condition which heretofore has been overlooked by everyone, including myself. I have not taken the temperature of my almost exclusively ambulatory practice, still one often finds on asking, or even subjectively, that towards evening, chill, cold shivers or transitory heat or sweat appear, and children become restless or irritable. Headache, dizziness, bad dreams and restless sleep, loss of appetite, coated tongue and bad taste, eruptions on the skin, foul smelling stools and often considerable thirst are present. The treatment of the fever is very important, and usually requires the mildest remedies; castor oil or tamarind, fresh or cooked fruit, flores sambuci or tilae, warm milk or warm, acid lemonade to cause perspiration, juices of lemon, raspberry, cherries, gooseberries, apples, plums, etc., with some sugar and not too cold water to be drunk frequently, I repeat frequently, during the day, abstinence from coffee, of whose injurious qualities I have frequently convinced myself, e. g., in a case of ulcer of the cornea recently treated by me, where in spite of my insistent and repeated forbid-

ding of coffee, the 17-year-old girl secretly drank it, whereupon and only on account of the fever being kept up by the coffee, there followed a perforation of the cornea with prolapse of the iris. This is a circumstance which in spite of the contrary belief of Prof. Schmidt-Rimpler (1. c. p. 432), is not very frequent, at least in my experience. Its existence in the Egyptian eye diseases is perhaps to be referred to the frequent drinking of coffee. Furthermore, it is necessary to abstain from tobacco and tobacco smoke in a room, from all alcoholic drinks. Through these simple means, which frequently may be used in association and charity practice (cf. succ. citri and syr. rub., idaei of the pharmocop. oeconom. Berol.), in conjunction with the above described treatment, frequently rapid amelioration or healing takes place, even of the crusting eczema of the face and head.

The stubbornness of "scrofular" diseases of the eye may frequently be due to the drinking of unhealthy febrile water, especially that of the Nile in lower Egypt (Alexandria), which, on addition of potassium permanganate, always, in 1880-1882, gave me a rich precipitate of organic matter. It is used in the preparation of coffee and the soda water and lemonade sold on the street, as well as the fruit ices, always used there unsterilized. Yet, in the eye diseases in Egypt, which, of course, also attack children, the effluvia, already observed by Lane[58], from the overflowed land, is of great importance, especially since, according to my observations, the ocular diseases there are often associated with purulent nasal catarrh. Finally, among the influences bad for the eye, is the dust from unpaved streets, as well as the piles of dust in the streets, which are used for heating baths. The high temperature of the air does not cause the diseases of the eye, since other countries in about the same latitude, such as Mesopotamia, Babylon, Libya, Malta, etc., were never rich in eye diseases. In contrast to Egypt, filled even at the time of Herodotus with physicians and oculists, in Babylon which was protected from overflow by the wonderful walls of Nitokins, there was at the time of Cyrus, not an oculist and not even a professional physician. The nomadic Libyans were the healthiest men whom Herodotus ever met (I, 185, 197; II, 84; IV, 187), and according to a description of

travels cited by John Locke, the Maltese children ran naked until 10 years of age, or "went without shirt, drawers or anything on their heads sheltering them from the scorching rays of the sun."

Sleeping near an open window, which often gives such good results in chronic nose and throat troubles, I have tried only in a few cases of scrofulous diseases of the eye, yielding too much to a popular belief. I employed it very recently with distinct success in a case of a 17-year-old girl with purulent conjunctivitis, rhinitis and blepharadenitis, whom I had treated for several weeks without result. By means of hours spent in forests, especially pine forests, or when it was a laborer who could not take a vacation, by means of evening and Sunday walks, I have cured stubborn catarrh which were not affected in any other way. For example, there is the case of a printer's apprentice who worked in a damp dusty room, and who shared a medium sized room with 10 other persons, of whom one was a sister suffering from purulent, foul-smelling fistula of the breast which had been operated several times without benefit. That in unhealthy dwellings only one child has eye trouble, is explained very simply on the ground of an unequal resistance of the children, perhaps due to a predisposition to diseases of the nose frequently observed by me. Change of residence must be insisted on if the living room is separated from a stall (pig-stye) only by a thin, pervious board-partition, which I saw in 1897 here in Danzig. H. Schmiegesell, July, 1897, hypopyon keratitis, purulent rhinitis. Vision=1/60; residence changed at once, ambulatory treatment with lavage; able to work July 16, '97, with vision=5/12. S., successor of latter, July 12, 1897, acute purulent rhinitis and conjunctivitis; residence changed at once, lavage, cure in a few days. Similar cases have been reported from East Prussia by J. Jacobson and Hoppe, from Ireland by Maria Edgeworth, from several places in France by Aimé Martin, from Hungary by Fener, also from Russia and Poland, where the unboarded floors of the clay cottages in the villages even today are freshened with soil containing cow dung.

The question of dwelling, so very important for the study of tuberculosis (scrofulosis), can of course not be discussed here any further; for example, the houses of St. Petersburg built on a swampy foundation and overflowed frequently by

floods from the Baltic Sea which yield annually thousands of eye cases; the streets of the present Jerusalem which are filled with rubbish, dogs and foul vapors, in which "ein müdes Leben schleppend seinen gang geht," and where every third man is blind in one or both eyes[59], many sanatoria which are built not like that in Lowschwitz near Dresden on a platform, but on a slope where in spite of their "sun rooms," their back rooms are damp at the time of melting snow or downfall of rain; the huts on the Riesengebirge, where the floors are damp in summer and the hut buried in snow in the winter; the sloping houses of a city so rich in nose diseases and trachoma as Trieste; the narrow-fronted, poorly ventilated houses of Danzig in comparison to the houses of Alexandria with their wide central courts, or the squares of London. Let us hope that the time is not far off when shutting up an eye patient in a closed room, or an overfilled, darkened and as little ventilated as possible "Clinic" will not be demanded, as the first step towards cure, when 97 to 98 per cent will be treated ambulatory, with light and air—a sea of fresh air—and when in the opinion of Brémontier, Oberlin, Aimé Martin, pastor Mattheus of Onstmettingen in Würtemberg and others, science will develop its whole force for the relief and cure of even "scrofular" diseases of the eye.

REFERENCES.

1.   For indeed she was flatnosed, wrymouthed and thicklipped, with huge, ill-set teeth, eyes that squinted and were even bleared, and a complexion between green and yellow as if she had spent the summer at Sinigaglia instead of Fiesole, besides which she was hipshot and somewhat halting on the right side (from English translation of the Decameron).

2.   Firenze, 1897, Bd. 2, S. 213.

3.   Cf. Ziem, Allgem. med. Centralzeitg., 1886, Nos. 68, 69; 1897, Nos. 30, 31.

4.   Beziehung zwischen den Krankheiten der Nase und denen des Auges, Arch. f. Laryngol. 15 Bd.

5.   Klin. Monatsbl. f. Augenh., 1895, July; Jour. of Laryn., 1895; Nos. 10, 12, and Transact. of the British Laryng. Assoc., 1895, Appendix, p. 15.

6.   Wiener klin. Woch., 1900, 41, 42.

7.   Cf. Ziem, Arch. Intern. de Laryng., 1903, p. 1173.

8.   Ebstein u. Schwalbe, Hanb. d prakt. Medizin, Ergäng. Bd., 1906.

9.   Möller, Handb. d. Augenh. f. Thierärzte, 1892, p. 34.

10.   Atti della Soc. Italiana di Laryng., 1905, p. 208.

11.   Handb. d. Augenh., 1876, 2, p. 487.

12.   Monatsch. f. Ohrenh., 1886, No. 2, Fall 24.

13.   Die entzündlichen Erkrankungen d. Stirnhöhle, 1895, S. 110.

14.   Zehnder's Monatsbl., 1895, July; Trans. of the British Laryngol. Assn., 1895, Appendix: and Journal of Laryn., 1895, No. 10 sq.; ibid., 1903, p. 284 sq.

15.   Abbild. d. Organe d. Geruchs 1809. Taf. IV, Fig. 16, 17.

16.   Anatom. Handatlas, 1877, 6, Taf. 266, Fig. 4; Taf. 267, Fig. 1, 2.

17.   Handb. d. topogr. Anat. 1885-90, S. 227.

18.   Gefrierdurchschn. z. Anat. d. Nasenhöhle, 1890-91, Taf. III, IV, X, XI.

19.   Atlas d. topogr. Anat. 1900, I, S. 121.

20.   Handatlas d. Anat. 1903, 3, S. 798.

21.   Anat. Atlas, 1906, 6, S. 912, 947.

22.   Physiol. u. Path. d. Thränenableitungsapp. 1850, S. 56, and Fig. 6.

23.   Lehrb. d. Augenh. 1885, S. 209.

24.   Allgem. med. Centralztg. 1887, nos. 37, 38.

25.   l. c. S. 110.

26.   Atti della Soc. Ital. di Laryng., 1906, S. 111.

27.   Sammlg.-klin. Vortr., 1904.

28.   Atti, 1905, S. 212.

29.   Zehender, Handb. 2 S. 500.

30.   Clinica moderna Firenze, 1904, No. 33; Atti, 1905, S. 207; 1906, S. 103.

31.   Handb. d. topogr. Anat. 1882, I S. 217.

32.   Möller, l. c. S. 34.

33.   Allg. med. Centralztg. 1887, Nos. 37, 48, 49; Monatsch. f. Ohrenh. 1893, Nos. 8, 9.

34.   Die Erkrankungen des Auges im Zuzammenhang mit anderen Krankheiten, Wien., 1905, S. 432.

35.   La Semaine med. 1897, No. 51.

36.   9. Aufl. 1905, 2 Bd. S. 876, 877.

37.   Topogr. anatom. Atlas, Taf. IV.

38.   l. c. Taf. III, IV.

39.   Topogr. Atlas, Fig. 29.

40.   Anat. Atlas, 6, S. 946.

41.   Arch. f. Laryngol. Bd. 17.

42.   Annal. des mal. de l'or. 1895, S. 236.

43.   Virchow's Arch., Bd. 64.

44.   Lehrb. d. Ohrenh. 2. Aufl., 1888.

45.   Cit. from A. Courtade, Arch. Intern. de Laryng. 1904, T. 17, P. 779.

46.   Berl. klin. Wochen. 1891. S. 283.

47. Bresgen und Abeles, Die Nasenspülungen, 1902, bes. S. 31.

48. Courtade, l. c. S. 780.

49. Centralb. f. Augenh. 1903.

50. Ziem, ibid. 1887, S. 131; Monatschr. f. Ohrenh. 1885, No. 9.

51. l. c. S. 461.

52. Hoppe, Trachom-Epidemie in Gumbinnen, 1898.

53. Cf. also Courtade, l. c. T. 18, p. 98.

54. Allgem. med. Centralztg. 1886, No. 20.

55. Arch. f. Augen. u. Ohrenh. 7 Bd. S. 211.

56. Monatsch. f. Ohrenh. 1892, No. 6.

57. On Education, Par. 7.

58. Cit. from J. Hirschberg, Aegypten, 1890.

59. v. Soden, Palästina, 1899, S. 73.

60. Education des meres de famille, 1883, T II, chap. XXII.

NASAL OPERATIONS.*

By J. Baratoux, M. D.,

PARIS.

During the discussion before the German Otologic Society, in May, 1903, and the London Laryngologic Society, in November of the same year, upon the subject of nasal operation, chiefly from the viewpoint of anesthesia and post-operative care, I was struck with the difference of opinion, for I had, for my part, adopted a method which up to the present has given me excellent results.

To begin with, in every nasal operation I reject general anesthesia, whether for a deviation of the septum, a spur or hypertrophy of the turbinates. I have only had recourse to it on one occasion, in a young South American woman who had a septal spur which I wished to remove with the electric saw. As this patient absolutely demanded that she be given chloroform for the operation, I was obliged to administer this anesthetic agent. I should add that having operated upon the nose of her sister under local anesthesia, my patient did not hesitate subsequently to let me use the same procedure for a partial tubinectomy which I did two years later. She voluntarily stated that she felt no pain, and preferred this method to the former, which made her sick for two days.

My procedure is as follows: Two days before and the day before operation, I give insufflations of boric acid and avoid all injections. Ten minutes before operaton I mop the nasal fossae with cotton upon an applicator dipped in the following solution:

<div style="text-align:center">

Cocain hydrochlor 1
Adrenalin sol. 1 to 1000....... 5
Sterile water 5

</div>

Generally I content myself with a single mopping, but if the nostril is too narrow from swelling of the mucosa, I use a preliminary spray of this solution diluted with sterile water.

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*Translated by Albert Miller, A. B., M. D.

In passing, I recommend to my confreres who use a large number of these aplicators, a proceeding which I have employed for several years, to cover them with cotton. By means of a spinning-wheel which I have so modified as to be able to introduce the point of the applicator, I can obtain in one hour 40 applicators regularly covered with cotton. These are then placed in flasks and sterilized.

Five minutes after the first nasal mopping, I do a second with the following mixture:

Carbolic acid crystals.......... 1
Powdered menthol 1
Triturate to liquidation and add
Cocain hydrochlorate.......... 1

At the end of about five minutes the anesthesia is manifested by a peculiar sensation in the upper incisor teeth. The patient loses sensation in these teeth. This anesthesia is sufficient for an operation of half an hour or longer.

I have sometimes had recourse to submucous anesthesia with cocain solution or Schleich's solution. I will say that I have never obtained so good an effect with these as with the method which I recommend.

There is now to be considered whether or not a dressing should be put in after operation.

Where operators have expressed such divergent opinions upon this point, it is because fear of infection has determined them to use no dressing or not to leave it in the nasal fossae more than two days; and then it is very difficult to remove it without producing hemorrhage. I believe I have solved this question by the use of gauze strips with salicylic acid. Salicylic acid possesses well-known analgesic and antifermentative properties.

These strips, 0.20 m. in length by 0.02 m. broad, are dipped in a 10 per cent solution of salicylic acid. In certain cases I use wider strips, 0.05; when the nasal fossa is very large, for example.

When the operation is finished, I insufflate powdered aristol to arrest all flow of blood; then I introduce a strip to the furthest extremity with my forceps, which are concavo-convex. I place it so that this strip is well applied to the posterior part of the turbinate, if it is a turbinectomy, for it is often from this portion of the turbinate that subsequent hemorrhages come. (In passing, I want to say that I am

not an advocate of total turbinectomy.) This first strip should be well packed in the posterior nasal fossa, and so that it will not fall into the pharynx. This accident is easy to avoid if the depth of the fossa is observed beforehand.

This piece of dressing being placed, I introduce two or three more, packing them little by little. If the fossa is not sufficiently filled up, another strip may be applied above the others. Finally, close the naris with a bit of cotton, which may be replaced in twenty-four hours with cotton moistened with hydrogen dioxid.

If during the application there comes on a sanguinolent exudation, it may be easily stopped by putting powdered aristol between the layers of gauze.

I have never seen a serious hemorrhage follow this dressing, consequently it is hard for me to say whether or not adrenalin favors secondary hemorrhage.

Several years ago, when adrenalin was unknown, I used some extract of suprarenals. With this agent I had two marked hemorrhages. The first case was that of a young girl in whom I removed a small spur with the electric saw after mopping the mucosa with extract of suprarenals. This patient concealed from me the fact that she had had several serious hemorrhages from the extraction of teeth. Neither hydrogen dioxid, nor antipyrin nor ferripyin, nor gelatinized serum, nor tamponing would arrest the hemorrhage, which finally stopped upon giving ergotin subcutaneously.

The second case was one of narrowing of the nose from traumatism. A hemorrhage coming on in the course of operation, I tried to stop it with tampons dipped in extract of suprarenals. Immediately the blood flowed in greater abundance. I had to resort to tamponing. I repeat that I have never seen such an accident with adrenalin.

After the operation, the patient remains under observation in my office for about an hour. During the first day the patient keeps to his room. Every three or four hours he renews the cotton in the vestibule, after dipping it in hydrogen dioxid.

The next day the patient comes to me again and I take out the cotton and sometimes even a part of the gauze, after spraying with or injecting hydrogen peroxid. For that matter, it is advantageous to use the injection in order to remove the gauze, especially in operations upon the septum, as in submucous resections. If there is a flow of blood I put in

a bit of gauze after insufflating with aristol. During the day the patient moistens the dressing with hydrogen dioxid.

Generally I take four days to remove the dressing entirely. Frequently I do not get it all removed until the eighth day. It is then blackened, but has no odor and does not inconvenience the patient. By this procedure I have never seen any infection such as arises with ordinary packing even when left in the nose only a short time.

In closing, I wish to remark that patients sometimes complain of a tickling in the nose which will provoke sneezing unless the root of the nose is firmly grasped by the finger. It is not the first dressing after operation which produces this disagreeable sensation, but only when it is necessary to replace one of the gauze strips.

XCI.

PSEUDO-FRONTAL SINUSITIS ; SUB-PERIOSTEAL ABSCESS OF THE FOREHEAD COMPLICATED BY THROMBO-PHLEBITIS OF THE SUPE-PERIOR LONGITUDINAL SINUS EX-TENDING TO THE LATERAL SINUS AND JUGULAR VEIN ON THE OP-POSITE SIDE; MENINGITIS; DEATH; NECROPSY.*

By Dr. V. Delsaux.

EDITOR OF LA PRESSE OTO-LARYNGOLOGIQUE BELGE.

BRUSSELS.

Through the kindness of the President, I have been invited not only to attend the present meeting but also to read a paper on a subject which I hope will be of some interest.

Two months ago there came under my observation at St. John's Hospital a woman, aged 20 years, who complained of severe headache, sleeplessness, fever and prostration of two days' duration. Before that time, she had been quite healthy and had never suffered from any disease of the nose or accessory cavities. She was married and had two healthy children.

Examination of the patient showed the following:

Pharynx, somewhat inflamed, mucous membrane relaxed and covered with pus. Nasopharynx, covered with muco-pus. Nose, partially obstructed on the left side by deflection and spur of the septum. The right nasal cavity was quite free but somewhat purulent in its inferior part, while the middle turbinate and the septum were found to be in contact.

After the use of cocain and adrenalin for a few minutes, the mucous membrane of the middle turbinate became less swollen but the pain continued as severe as before.

On transillumination both frontal maxillary sinus were found translucent. No exploratory puncture was performed.

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*Read at the meeting of the British Medical Association, Toronto, August, 1906.

Ears.   Nothing of importance was discoverable; the patient did not complain of pain or tinnitus.

Before recommending any surgical intervention, I advised the patient to snuff boro-menthol-cocain ointment into the nose every half hour, to take an aperient and to have a warm foot-bath in the evening.

On the following day the condition remained about the same so I advised the paient to enter the hospital; this she refused to do.

In view of the possibility of purulent retention in the ethmoid cells, the anterior part of the middle turbinate was resected and after light plugging with stypticin gauze, the patient was allowed to go home.

Two days later, the patient came to the hospital. I found her complaining of more and more pain in the right side of the forehead above the eyebrow. Pressure on this place caused severe pain. There was swelling of the skin but no fluctuation. The temperature was 102.5° in the morning, rising to 104° in the evening.

Lumbar puncture was immediately performed and examination of the eye fundi made. On the day after, I found the patient's condition much worse; the swelling of the forehead had greatly increased and fluctuation was present.

The observations on the lumbar puncture were as follows: Pressure of liquid much increased; lymphocytes 35 per cent, polynuclear 16 per cent; some blood corpuscles present.

Examination of the fundi showed congestion and subpapillitis on the left side (while the pain was felt on the right side).

I then opened the subperiosteal abscess, evacuating a teaspoonful of pus and explored the right frontal sinus which was found to be quite normal. There were no congestion or swelling of the mucous membrane and no pus.

I put a drain in the sinus opening and another under the periosteum and applied a dressing. In the evening there was no improvement; the temperature was 104.5°. When I saw the patient on the following day the fever was still 103.3°, the prostration had increased and there was a swelling behind the left ear. Pressure over the mastoid was very painful, while examination of the ear showed drum free from all swelling and Schrapnell's membrane red but not bulging.

Below the mastoid there was an extensive edematous area but no pus was found upon puncturing twice.

The prostration increased very considerably in the evening of this day and death occurred on the following night without convulsions, rigors or paralysis.

I was fortunate enough to secure an autopsy, with the following results :

On opening the skull, great difficulty was experienced in separating the meninges from the bone on the right side. When they were divided in the median line, an intradural layer of pus was found over the surface of the anterior part of the right frontal lobe.

The longitudinal sinus was thrombosed, while the left lateral sinus was also found thrombosed but it had undergone purulent disintegration as far as the jugular bulb.

Further on, lower down in the neck, the vein was thrombosed but there was no pus.

Both frontal sinuses, ethmoid cells, sphenoidal and maxillary sinuses were explored without the least trace of inflammation being discovered. Nothing abnormal was found in the left ear.

There was nothing of importance in the heart cavities. The uterus, which was examined for obvious reasons, was quite healthy, as were the kidneys and other organs.

The following is, it seems to me, a plausible explanation of this case :

For some unknown reason a subperiosteal abscess formed above the right eyebrow, rendering the diagnosis uncertain during the first three or four days.

The resection of the anterior part of the middle turbinate had nothing to do with the fatal result.

While microscopic examination does not enable us to prove any association between the external purulent focus and the obliteration of the superior longitudinal sinus, it is quite probable that a microscopic examination would have shown a purulent thrombosis of one of the communicating bone veins, the so-called emissary veins.

As to the extension of the thrombosis to the left lateral sinus, it is to be supposed that there was a wide and direct continuity between these two blood vessels.

If we ask what indications the lumbar puncture could give us, it is to be noted there was a positive and undoubted change in the lumbar fluid.

At the same time examination of the fundus of the eyes revealed a distinct difference between the two optic papillae—the greater alterations being found on the same side as the lateral sinus thrombosis.

On the other hand, the fever was quite continuous, not at all remittent, as commonly happens in cases of jugular thrombosis.

Finally, it is to be considered that no paralysis being present, there were no focal localizing symptoms, consequently no indications for operating on the skull. Thus my conclusions are:

1. A genuine thrombosis of the longitudinal sinus may occur without any extension of a septic infection from the nose.

2. Epistaxis may be entirely absent as a principal sign of the thrombosis.

3. The anatomic reason for the more frequent extension of the thrombosis of the superior longitudinal sinus is the broad and direct communication between these two blood vessels, found in the majority of instances, while the straight opens rather directly into the right lateral sinus.

4. A preliminary exploration of the frontal sinus is to be performed for the same purpose as exploratory laparotomy in abdominal cases.

INTERCRICO-THYROID TRACHEOTOMY AND DE-CANULATION.*

By Prof. E. J. Moure,

EDITOR OF REVUE HEBDOMADAIRE DE LARYNGOLOGIE, D'OTOLOGIE ET DE RHINOLOGIE,

BOURDEAUX.

Several years ago (August, 1900), I addressed the Paris Academy of Medicine upon the difficulty of decanulating infants and children whose air passages had been opened in the intercrico-thyroid space and the canula left in place several weeks or months.

Since that time I have had occasion to observe numerous cases which corroborate the opinion I then expressed as to the causes of these laryngeal stenoses.

If we consider the very small space presented by the inter-crico-thyroid region in the infant and child, we easily recognize that it is impossible to place a canula here without cutting the cricoid. Further, I have seen practitioners impelled by the grave asphyxia of their patients, open the thyroid as well as the intercrico-thyroid space, and consequently place the canula partly within the larynx.

In these cases the foreign body is situated immediately in the subglottic region, in the neighborhood of the vocal cords. As a result there is chronic swelling of the irritated part and an infiltration which of itself is almost sufficient to prevent the passage of air by way of the larynx. There is actually a chronic edema in a region which cannot dilate and this as a result produces considerable stenosis.

If we reflect further, that to instal the tracheal canula it is necessary to spread open the two plates of the cricoid, we readily understand the effect upon the crico-arytenoid articula-

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*Communication to the Surgical Congress, October, 1906. Translated by Albert Miller, A. B., M. D.

tions which would ensue upon opening such an important cartilage, and one which sustains the articulations active in breathing.

The almost complete immobilization of the arytenoids behind, by spreading the cricoid ring and the subglottic infiltration previously mentioned are two factors which combine to produce a laryngeal stenosis, temporary at first, then permanent, or in any event a very grave one, if children are not quickly decanulated before there is rigidity or ankylosis of the articulations which then no longer functionate, so to speak.

This also explains the socalled spasms of the larynx which attend some decanulations in patients having flexible cartilages, tracheotomized in the intercrico-thyroid region.

I have very often seen this phenomenon even in adults, in conditions above mentioned. It is the rule in children, so to speak.

The therapeutic conclusions from this way of looking at it are readily deduced.

If for any reason whatever an intercrico-thyroid tracheotomy has been done upon an infant or child, the canula must be removed as soon as possible to avoid the glottic and subglottic laryngeal stenosis which follows the prolonged stay of a foreign body.

In cases where laryngeal stenosis has already supervened, the patients are not to be treated at all by dilatation, for such intemperate maneuvers only irritate the inflamed region. They also have the grave inconvenience of producing cicatricial synechiæ which are now serious, for these permanently obstruct the larynx by creating an incurable tubular narrowing, thus condemning the patient to wear a canula always thereafter.

As Schmiegelow said several years ago, and as I myself advised about the same time, the first duty of the surgeon should be to place the canula in the trachea below the point where it had been, taking care to leave a ring of healthy tissue between the two incisions, to avoid the tube slipping up into its former situation.

This done and the respiration being assured, we wait patiently for time to do its work, for the infiltration to be slowly absorbed, and for the arytenoids to resume their function, if not normally at least sufficiently to assure the free entry of air into the uper passages.

At this period, after being sure of permeability of the larynx by direct examination, we may decanulate the child, but not without first habituating it for some weeks or months to natural breathing by closing the canula.

I will not multiply the observations which support this view. I will content myself with saying that every time I have seen infantile laryngeal stenosis it was produced by a tracheotomy too high up and in the course of which the cricoid had been divided.

In the cases which I have had to treat I have done more by patience and displacement of the tube than by the dilatation which these young subjects had undergone, a dilatation which was usually ineffective and sometimes even harmful by reason of the ulcerations and cicatricial synechiæ which it occasioned.

To sum up: Intercrico-thyroid tracheotomy constitutes in general a bad operation for patients with flexible cartilages.

It should be reserved for urgent cases, in which it is certain that the canula will not be left in too long, or for adults with dilator paralysis or even aneurysm, in whom it is a matter of putting in a permanent canula which will never be taken out, such as we unforunately meet with in practice, in tabetics or others attacked with bilateral paralysis of the vocal cords.

The intercrico-thyroid is a tempting operation for it is easier to perform than a true tracheotomy, but it must be admitted that the latter is not very difficult in infants or children, and that in adults there is usually time to intervene before asphyxia sets in.

An important point, to avoid cutting the cricoid, is to take the latter as a landmark and as the upper limit of the cutaneous incision.

XCIII.

NOVEL METHOD OF TREATMENT OF SYNECHIA OF THE PHARYNX.

BY EDWARD J. BERNSTEIN, M. D.,

KALAMAZOO, MICH.

The treatment of cases of more or less total synechia of the pharynx has always been of great concern since attention was first directed to it. Most men give up in despair and those cases which are fought out to a successful issue must each be taken as a law unto itself.

Nearly every rhinologist has tried some new trick and nearly all accord more failures than successes.

In the mechanical treatment of this case I believe I have something novel to offer, inasmuch as I have seen no reference to such and no one to whom I have written seems to have attempted it.

The case is as follows: Bert F. was sent me by Dr. John B. Jackson with this history: at the age of 9 (3 years ago), he was taken with an attack of diphtheria in which the whole soft palate and pharynx became involved in an ulcerative process. There was also ulceration present in larynx. As a result of this, the anterior and posterior pillars of the fauces, together with the soft palate were glued into one solid mass to the posterior wall of the pharynx, except for a minute point in the median line, through which I could pass a very fine sound.

In the larynx, nothing normal remained but the epiglottis and the anterior two-thirds of the left vocal cord; the rest was taken up by huge masses of new growth. It was marvelous how the little fellow managed to breathe at all through so small an opening. His voice was entirely gone. As a result of his total synechia in the pharynx and a subsequent attack of la grippe, and the blocking up of the nasal secretions, there appeared an otitis media suppurativa chronica with necrosis of the mastoid and polyps in the middle ear, all of which I demonstrated to several colleagues.

Cultures taken from the ear showed staphylococci albi and aurei, but no streptococci nor other organisms.

He came to me a pale, cadaveric looking, undersized boy of twelve, with constant dyspnea—mouth always open and with a most offensive smelling ear.

After reviewing my own lack of successes, and looking over the devices suggested by other operators to overcome the synechia, I decided to try the expedient suggested to me by Dr. Fletcher Ingalls, that of attempting to pass a thread through the scar tissue between the mouth and the nasopharynx. This I found to be unfeasible, owing to the ivory like denseness of the scars and to the further fact that, when I did finally succeed in passing one thread through and tying it in a loose knot, instead of slowly working its way through and the opening becoming epidermicized, as is the scope of this procedure, the resisting power of this structure was so poor that it tore through in a few days and the opening healed up almost as fast as it formed.

I then decided to punch out a lage mass from one side with the punch-forceps used for tonsillectomy. I obtained a large hole thus and in attempting to repeat the procedure on the other side, a few days later (under ether anesthesia) the boy suddenly became cyanosed and stopped breathing, owing no doubt to the irritating influence of the ether down his already nearly occluded windpipe, and a rapid tracheotomy was necessary. I had fortunately provided myself with a tracheotomy tube. We were thus able to restore the boy, who appeared to be dead. In a few weeks we were again able to operate on him and this time a very large opening was made from the mouth to the nasopharynx.

The problem of how to prevent closure presented itself. After much experimenting, I finally determined to have the dentist make a plate which would fasten on his last molar teeth on the side and his incisor teeth in front, which plate, fitting like that for a set of artificial teeth, should carry on its posterior border an inverted "U" shaped plate—very similar to the blade of the Gottstein curette—whose function it was to keep open this aperture. We found this shape best, as it left the soft palate free and thus did away with the irritation of a foreign body on this structure. The boy wore this, after a very short trial, with perfect comfort and it did the work admirably. I am indebted

for the execution of this device to the ingenuity of my dentist friend, Dr. A. Chisolm of this city.

As a result of our ether anesthesia, he sustained a severe tracheitis: it was while waiting for this to subside sufficiently to enable us to do a radical mastoid operation, as the next step in the series of operations that we had planned, that his tracheotomy tube became suddenly clogged up and before help could be summoned, he choked to death.

At the post-mortem, no evidence of tuberculosis could be found, though every organ was subjected to microscopic investigation. Aside from the condition of the larynx, which was a pathologic curiosity, nothing but a few broken down mediastinal glands were found, no giant cells or tubercles could be made out.

Through the thorax I was able to take out the entire larynx, and through a linear incision away behind the hair line, I was enabled to get out the entire temporal bone.

A full pathologic report of the larynx and mastoid will follow as soon as I can decalcify the temporal bone and cut it. This part will be quite interesting, as it contains a large aural polyp in situ, as it is rather rare to obtain a specimen in which such were demonstrable in vivo.

XCIV.

A NEW SELF-RETAINING NASAL SPECULUM.

By John H. Allen, M. D.,

PORTLAND, ME.

The self-retaining nasal speculum illustrated herein, was devised by the writer about two years ago, to facilitate the performance of submucous resection operations upon the nasal septum, and has been found so useful in the hands of the writer and others, that notwithstanding the long list of similar instruments already to be had, he feels justified in calling to it the attention of those interested in nasal surgery.

The resection, or so-called "window operation" calls for a greater delicacy of technic than any intranasal procedure has heretofore demanded. Done by the aid of cocain and adrenalin with a practically bloodless field, every step is accompanied by careful scrutiny and should be accomplished with precision, and for this reason it is important that the most favorable conditions for illumination should be obtained. As good illumination is indispensable, and as it is highly desirable at certain stages of the operation to have the free use of both hands, a speculum which will distend the anterior nasal opening to the greatest extent compatible with the comfort of the patient and at the same time be self-retaining, becomes a valuable addition to the armamentarium. This is true even when it is possible to obtain the services of a trained assistant, for even the most efficient assistant, while holding the speculum, will at times obstruct the light or interfere with the movements of the operator.

In spite of the fact, however, that the pages of a single instrument catalog picture no fewer than thirty different specula of the self-retaining type, it was found impossible to obtain a speculum capable of distending and holding the anterior nares in such a position as to permit of adequate illumination of the nasal cavity. In order to bring into view the floor of the nasal chamber together with the inferior portion of the septum and the lower turbinates, it is necessary that the tip

of the nose shall be thrown upward until the aperture becomes nearly vertical. This is accomplished by the ordinary bivalve speculum, held in the hand, but no self-retaining speculum could be found which would automatically elevate the tip of the nose. On the contrary, such specula either leave the nasal orifice in its normal, nearly horizontal position, or by their weight tend to drag the soft parts still further downward. In this position, even if the tissues of the vestibule are dilated to their extreme limit, it is impossible to see into the nose except by throwing the patient's head far backward, and then the structures in the upper part of the fossa, only, are brought into view.
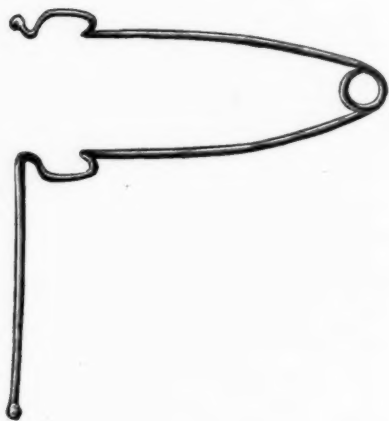
The present instrument differs radically from other self-retaining specula, already on the market, and which for the most part satisfactorily retain their position and keep the naris open, in that it thus maintains a vertical position of the aperture. This is accomplished, as will be seen from the cut, by means of a long tail or extension downward from the lower blade, which bears upon the lips and by this leverage holds the soft parts in the position most favorable for illumination and inspection.

The instrument is simple in construction, retains its place satisfactorily and without undue discomfort to the patient, and holds the opening in such a position that a full and adequate view of all parts of the septum may be obtained without chang-

ing its position. Its tension may be varied to make it fit large or small openings by merely exerting torsion in one direction or the other, upon the spring wire of which it is constructed. The nose-clips or blades, being of wire, are lighter and less ob-

structive than those of solid construction, and while it is true they do not press vibrissae out of the way, as do solid blades, this is not material in operative work, since the vibrissae should be cut away at the outset.
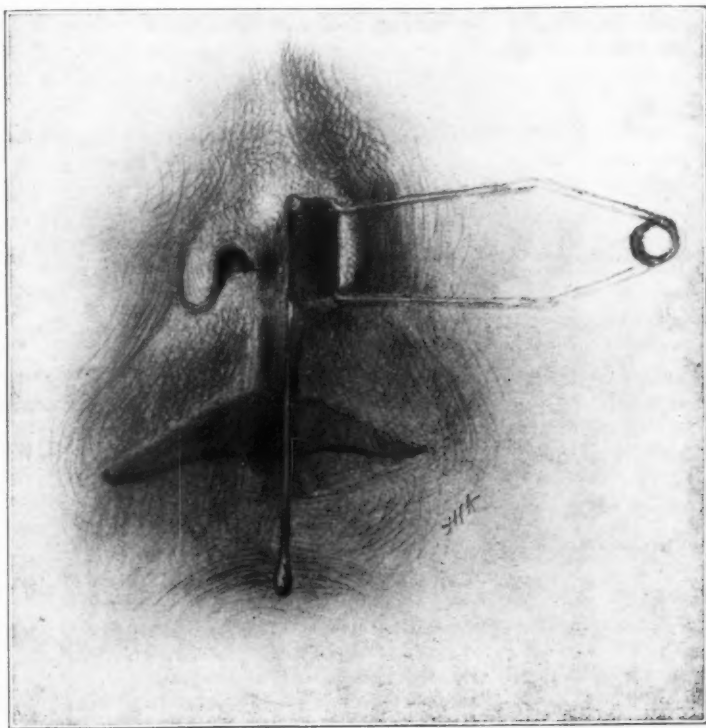
The speculum is made in rights and lefts.

NOTE.—I am indebted to Dr. David Hefferman for a suggestion in regard to the shape of the nose-clips, which improvement is incorporated in the present model.

INDEX OF AUTHORS.

INDEX OF TITLES.